ELECTRICAL REVIEW

[ILLUSTRATED.]

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A Comparison of Steam and Electricity as a Motive Power.

Cugnot, a Frenchman, in 1769 constructed an experimental locomotive, and since that time this noble machine has steadily and rapidly advanced. Symington, Murdock, Evans, Blenkinsop, Dedley, Stevenson, Ericsson, and many other later inventors have devoted their time to its perfection, and to-day the locomotive stands a monument to patience, ingenuity and skill, and is as near perfect in design, detail of construction and stability as the modern mechanical expert can devise. The engineer sits in the cab and by a series of levers controls its every movement; sending it dashing around curves, forces it to climb steep inclines, or stop within 500 feet when running at a speed of sixty miles per hour.

In the whirl of business excitement the magnitude of these achievements is not considered but is looked upon as something to be expected, and the American business man would probably hail with delight the advent of a train that would run ninety or 100 miles per hour, would start on a journey with as much indifference as he does to-day; notwithstanding that a train traveling between Detroit and Chicago depends upon the skill and faithfulness of about 200 persons and the carelessness of one of these would result in disaster.

Electric railways are not new. Lilly & Cotton in 1847 and Bone in 1848, having secured patents thereon. The use of electricity as a motive power remained in an experimental state owing to the cost of generating the current, it being accomplished in those days either by galvanic batteries or crude and imperfect dynamos. The commercial success of the dynamo being assured, however, the electricians again turned their attention to its use as a motive power, and in 1879 the Gross & Lichterfelde system was placed in operation, inaugurating a new era in this field of electrical research.

"Do you think the electric motor will eventually displace the use of steam?" a *Free Press* reporter asked of Frank E. Fisher, manager of the Detroit Electrical Works, and inventor of the motor which propels the Highland Park Railway.

"Yes, I do," was the reply. "Just consider the two systems. The steam locomotive is a combination of thousands of parts, every one of which must be perfect. It must carry a large amount of dead weight, which includes the tender, water, fuel and boiler. All of these are absolutely necessary, because it must generate its own motive power and carry fuel and water to keep the supply constant; and again the center of gravity is so far above the track as to produce the swaying motion observed in locomotives, rendering a much higher rate of speed unsafe. The longitudinal strain exerted by the pistons and parallel bars moving in opposite directions; the tremendous pounding of the track by the drivers; the dangers from explosion, and the chances of accident in so complicated a machine, are all serious difficulties to consider. The aim of every machinist is to make a machine that has as few parts as possible; this not only reduces the cost of manufacture but lessens the liability to get out of order. The electric motor is the very acme of simplicity. It possesses all the desirable features of the steam engine and none of its faults. Properly constructed electric locomotives would realize, in the highest degree, mechanical simplicity and efficiency; the entire weight of the machine could be placed below the axles of the driver, bringing the center of gravitation much nearer the track. It would not be necessary to carry a heavy and cumbersome tender; fuel being dispensed with, smoke and cinders would disappear from our trains, making travel more pleasant and agreeable. The engineer and fireman would be relieved from the care of steam and water, and in case of accident would no longer fear being scalded or burned to death. Railroad companies would not be obliged to establish and equip water and fuel stations; instruments could be placed on the motor to detect the approach of a train from the opposite direction, thus averting disasters, and finally motors would not cost much more than one-half the price of locomotives. The power stations could be placed where fuel and water could be obtained cheaply, and in many cases water power could be utilized to generate the current.

"This may seem like a dream to you, but I think you will live to see the day when railway trains will be drawn by a machine stripped of boiler and tender, moved by an unseen power, riding as easily as a palace car, and dashing along with very little noise and no smoke; the only care of those in charge being the safety of their train."

"Mr. Fisher, it is said you have nearly completed something entirely new in the way of electrical motors," said the reporter.

"Yes I have," was the response with some surprise. A request for a glimpse at it was acceded to, and repairing to another portion of the works, the new motor was disclosed to view. To the casual observer it was nothing more or less than a wheel three feet in diameter, the supports for the shaft being set on a wooden framework. The most noticeable feature was the amount of wire used in construction. Mr. Fisher explained that it was constructed almost entirely of wrought iron and about seven miles of copper wire. The power is obtained by rotating an armature between two large wrought iron pole pieces. Power is supplied to the car by means of a sprockett wheel, which moves an endless chain. The current is taken to the motor by means of a contact wheel in combination with a third rail. The circulation of the current through the field magnets reduces magnetism in the pole pieces of one polarity and in the armature of an opposite polarity. Polarities of an opposite nature have an affinity for each other, and this produces action in the armature, which in turn moves the car. Simply stated the current from the power station is applied through a third rail to a contact wheel. This moves the armature, or large wheel of the motor, which is connected by an endless chain to the car wheels.

"When do you expect to put this motor in operation?"

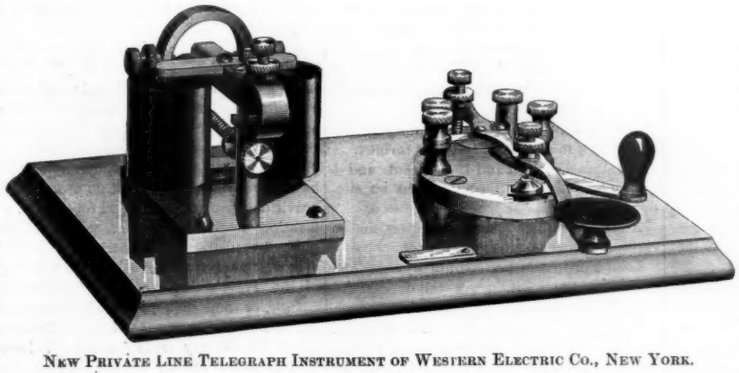
"Some time during January. The Pullman Car Company are now building a motor car, and as soon as it is completed the motor will be put to work."

"Where is it designed to be used?"

"On the Highland Park Road. It is meant to pull three cars, which will be necessary to take care of the heavy summer traffic of the road, and it will also be used to push a snow plow if necessary. The motor will occupy the entire car being built for it, and there will be nobody in that car but the motor man. The motor will be within eight inches of the track and nearly on a line with the car wheels."

"What speed do you expect to attain?"

"From thirty to forty miles an hour, pulling three cars. Come out when we get started and we'll give you a lively ride."—*Detroit Free Press.*



NEW PRIVATE LINE TELEGRAPH INSTRUMENT OF WESTERN ELECTRIC CO., NEW YORK.

New Telegraph Instrument of the Western Electric Co.

The cut on our first page illustrates a new private line telegraph instrument, manufactured by the Western Electric Company, New York. It is different from other private line instruments, which have been offered by this and other houses, only in the fact that it is particularly neat and handsome, and particularly cheap. The company is meeting with great success in introducing the instrument, all users being particularly pleased with its work.

— The Brush Electric Light and Power Company of Savannah, Ga., has declared a dividend of $3.00 per share, payable this month.

Some Experiments on Secondary Cells.

BY JAMES SWINBURNE.

This paper is a very condensed account of a large number of experiments made in the spring of 1883.

About four years ago Mr. Norman Cookson, of the well-known firm of lead manufacturers in Newcastle, brought out a process for making lead in the form of fine fiber or hair. Mr. Cookson's method is this: The lead is melted in a pot, which is raised some feet from the ground. From the melting-pot is a tube which leads down some six feet, and ends in a rose, like that used on a garden watering can. The fall tube is kept hot throughout its length, so that when the lead is melted in the pot it is not solidified in the pipe. The melted lead then flows through the fine holes in little jets, and these jets solidify in the air, and fall in a tangled mass like lead moss. Some care has to be taken to keep the lead in the pot, and in the tube, at the right temperature; but this is the only difficulty, and the whole cost of the lead hair is not more than two shillings per ton above that of pig lead.

Those who were working at secondary batteries this time four years ago will remember that most people had the idea that the great thing to be aimed at was a very large surface. Mr. Cookson's invention, therefore, seemed most valuable, and he set to work with the energy which is his characteristic, especially when working at something new. Mr. Cookson made up a dozen large cells, which he sent to Mr. Jameson, the inventor of the coke process, who was then working at an incandescent lamp. Some of the lead hair was made up in to little cells and tried in various ways by Prof. Herschel, of Newcastle. Prof. Herschel published some account of his work in *Nature*. Mr. Cookson also made arrangements with the writer to go into the question of secondary batteries. The theory that large surface of lead was necessary gave way when the question of local action was more fully studied; but after all it seems to be near the truth.

Some reason may be demanded for bringing before this society the account of experiments which were made so long ago. Many of them have been made again since, and many are of no use at all; but, on the other hand, there are a number which are still new, and the next best thing to knowing what to do is knowing what not to do. We made altogether more than three hundred different cells; but, to prevent this paper running to too great a length, only a few of them are described.

Cells With Hair Lead.—The first were Mr. Cookson's large cells. These had four plates; each plate was about 8 inches by 10 inches by 1 inch, and consisted of a sort of cage of sheet lead with holes in each side. The lead was joined by burning, no solder being used. The inside of the cage was filled with lead hair, a lead wire being arranged zig-zag through it, and burnt to the cage. Each plate was sewn in flannel. A battery of twelve of these cells was sent to Mr. Jameson to be charged. They came back to the lead works without any particulars as to what

had been done with them. We therefore coupled them up with dynamo, and charged them in what appeared to be the opposite direction. They had 12 amperes through them for about seven hours a day for no less than five months, and even after three months gas was coming off the reduced plate only. The cells seem to have had enormous capacity, and must originally have been charged in the other direction. After three months the reduced plate gave off gas, but the peroxide plates went on charging for the whole five months. We did not try running them down to see what charge they really had, as other experiments which were going on at the same time led us to suppose that the local action would render them useless. Probably the surfaces of these plates were so large that the local action formed enough sulphate of lead during the night to utilize current during the whole of the next day in oxidising it. At the end of the five months the flannel round the plates was not spoilt. This seems to show that it is not the acid that spoils the flannel in the Faure cells, but the oxidation due to the contact of peroxide of lead. Some experiments on organic substances with oxidising agents will be described presently.

The first difficulty to be overcome with the Cookson lead hair was making good electrical connection with the support. Various methods of soldering were tried, but the little wires of lead were melted off whenever it was tried to burn them to the back. Solder with a flux of caustic soda ran along the fibers too much. Various methods of connecting the fibers by pressure were tried. The material was woven into loose mats, and these were passed under large rollers. Every degree of density could be obtained in this way. Though the metal was clean, and appeared to stick together at first, it did not adhere as strongly as might have been expected. The chief fault of the lead hair seemed to be the vice of local action. In those days local action was not so well understood as now. The theory seems to be this: If lead and peroxide of lead are electrically connected, and any of the surface of the lead is exposed to the acid, that part of the surface is attacked, and a thin film of lead sulphate is formed, which protects the surface from further corrosion. The lead is then in contact with the peroxide at some points, and with lead sulphate at other points, but is not touched by the acid anywhere. If the cell is charged further, the film of lead sulphate is oxidized into peroxide, so that the plate again consists of lead and peroxide of lead only. As the peroxide formed from a given quantity of lead sulphate occupies much less room, a small portion of the surface of the plate is again exposed, but it is immediately coated with a film of peroxide; the result is that the whole surface of the plate is protected. The least movement seems to expose some of the surface of the lead to the acid. The lead can thus be protected by anything that prevents its contact with the acid. For local action to take place, some of the lead must be exposed to the acid. If, while a cell is charging, a clean surface be made on the peroxide plate, it will immediately be covered with a thin film of peroxide, which will protect the plate from further attack. If, on the other hand, the dynamo is disconnected and a clean surface then exposed, it will be immediately covered with a film of sulphate which will protect the plate. Thus the plate may be protected either by sulphate or peroxide. When the lead of a plate is converted into peroxide, the plate is being charged. When the lead is converted into sulphate, local action is going on. In the large Cookson cells the fibers of lead were converted into sulphate during the day by charging, and more lead was converted into sulphate during the night by local action; so that it was unnecessary to reverse the batteries to secure more rapid formation, the formation being already rapid enough. Mr. Crompton told me this summer that he found that cells were practically indestructible if not discharged too much, and this seems to be the grand secret of successful work with secondary batteries. Messrs. Drake and Gorham mentioned the same thing in their paper read at the British Association this autumn. Either the peroxide of lead is so porous that it never quite protects the plate, or it is disturbed by small bubbles formed in the coating; for if a current is passed continually in one direction, a lead pipe is eaten into, as may be seen in a water resistance with lead electrodes—the oxidised plate seemingly does go on forming. In the lead hair cells the surface exposed was so enormous that a very slight formation was enough to demand a very large supply of electrical energy, so that the cells seemed to run down as fast as they were charged. No doubt the fault was that the fibers of lead used were rather too fine; if we had used much thicker lead wire, we should have probably made a very good battery. Several plates were tried with hair lead, red lead, litharge, etc.; but our ideas as to the validity of Faure's patent were not quite what they are now, so comparatively little was done in that direction.

Secondary cells are, however, tedious things to experiment upon. It may take a year or so to see what a cell is going to do. The best method is to keep several sets of experiments going on at the same time.

For the sake of conciseness some of each class will be given, arranged in groups.

Quick-forming.—Cells were made with lead hair in a solution of sodium chloride; the anode was quickly attacked, but the coating was not adherent, and came off in clouds; black clouds presumably of finely-divided lead, came off the other plate.

Lead hair and potassium bichromate: seemed to oxidise well.

Lead hair and potassium sulphate: no very marked result.

Amalgamated lead in dilute sulphuric acid: the peroxide formed had little stiction or power of adherence, and kept peeling off and exposing the bright amalgamated surface; this happened especially on reducing.

The object aimed at was to get an electrolyte which partly dissolved the plate; the idea being that an action like that of which advantage is taken in the manufacture of white lead might be used in the quick formation of battery plates.

Lead in solution of sodium-thiosulphate: thick black mud of lead sulphide formed.

Amalgams of lead and 10 per cent. and 5 per cent. of mercury: coating had no stiction.

Alloy of lead and zinc: this was not so easily attacked as one might expect.

Lead hair in solution sodium hydrate and sulphide: the solution got yellow, and deposited sulphur on the oxidised plate.

Lead in solution of ammonium chloride: was no better than the similar cell with sodium chloride. No doubt a little nitric acid was formed, but the cell was not a success.

Cells were tried with solutions of potassium fluoride: the plates were not formed well.

Lead in potassium sulphides: not much attacked; the action of the sulphide seemed uncertain, and is partly dependent on the amount of hydrate present.

Lead plates in solution of salt, with felt between: after reversal this gave good spongy lead, but a great deal of the peroxide was loose and detached.

Lead with various mixtures of sulphides and carbonates and nitrates: none of these gave deposits which would reduce well—they were all too loose.

Lead in sulphuric acid: just diluted enough to make it conduct; the anode was not much attacked.

Lead in a mixture of sulphuric and nitric acids: more quickly formed.

Lead in nitric acid alone: eaten through very quickly. The action of nitric acid on a lead plate is very peculiar. Most of the solutions already mentioned attacked the plate evenly and oxidised it gradually through, but nitric acid makes pits and round holes. As nitric acid seemed by far the best means of quick formation, several experiments were made with it. Plates were eaten wholly through with acid which was too strong to dissolve much nitrate; the acid was then siphoned off and replaced by a solution of sodiuum sulphate and reversed. There was difficulty in reducing the lead sulphate; it formed cakes which did not make good contact with the plate. The great objection to the various methods of forming above described is that the coatings produced have too little stiction to reduce well. When lead was the anode in nitric acid no peroxide was produced. Of course no peroxide is formed when the plate is in contact with sulphuric and hydrochloric acids, as peroxide of lead liberates chlorine in an acid solution, while chlorine precipitates lead peroxide from an alkaline solution of the lead salt.

The best solution we tried for forming plates was a mixture of dilute sulphuric and acetic acids; this solution made a line and adherent coating which reduced well. One of the most obvious disadvantages of such solutions as dilute nitric acid is the difficulty of getting rid of the least traces of acid; of course, traces of such things as nitric or hydrochloric acid in a cell may be very destructive, or they may be quite harmless. Acetic acid can easily be driven off as vapor, and nitric acid might perhaps be reduced to ammonia and then volatilized.

Mr. Brush heats his plates to accelerate their formation; we did not try this.

Local Action.—To reduce the local action in the peroxide element we tried amalgamating the plates; this did not act. We tried to gild lead plates, but did not succeed; a gold sleeve link seemed to act well as a support for a little peroxide plate, and it was hoped that gilding might preserve lead. We tried to protect lead by various sulphides. These experiments seem absurd; in fact, many of our experiments were rather wild; but the supposed method of protecting plates has recently been patented by no less able a chemist than the late Mr. Tribe. Lead was fused with various proportions of galena, and the resulting substances were tried as anodes. Galena itself is at once coated with lead sulphate when used as anode in dilute sulphuric acid.

Lead was also combined with arsenic by heating in glass tubes. This was very troublesome work, as the arsenic was apt to volatilize, and sometimes the tubes broke, and the laboratory had to be abandoned until the smell was gone.

Double sulphides of antimony and sulphur bases were tried, but were of no use. In our provisional protection, applied for in 1883, we mention coating the plates with lead sulphide by means of thiocarbamide. This idea was taken from a receipt seen in a copy of the *Plumbers' Times and Paperhangers' Gazette*, or some such paper, which was sent me with an intimation that I had no business not to take in my trade journal. Thiocarbamide could not be bought, and was too troublesome to make, so this plan was now tried. The process is said to produce a beautiful polished adherent coating of lead sulphide on lead, or even on organic substances such as netting, and is of very considerable interest, and perhaps of commercial value.

Silver was tried as peroxide plate in various solutions. It behaved very much like lead, though it is not so easily attacked by sulphuric acid; peroxide of lead sticks to it well, but of course it is too expensive for commercial use. Silver might be used for connections. Most metals exposed to the action of the spray from secondary batteries are attacked, and make bad contact, but silver may be laid across the top of a cell without tarnishing. Probably electro-plated copper would do as well. Very few experiments were tried with platinum because of the expense. Mr. Brush has patened plates made of an alloy of lead and platinum. Most likely it would take a very large proportion of platinum to protect a plate, as the alloys of platinum are easily oxidizable No doubt Mr. Brush's invention is only waiting for the discovery of a platinum mine.

Local action may be a very serious evil in reduced plates, especially with strong acid. Local action on the reduced plate must not be confused with local action on the peroxide plate. It does not here take place whenever a clean surface of lead is exposed to the acid, but when a body sufficiently electro negative to lead comes in contact with it, and enables the spongy lead to combine with the acid by evolving hydrogen from the electro-negative body. In some cases reduced plates in dilute sulphuric acid give off little bubbles of gas continuously for a couple of weeks. Spongy lead seems to have very nearly strong enough affinity for the electro-negative radicle of sulphuric acid to combine by evolving hydrogen, more especially if the acid is strong. It seems likely that traces of some metal even slightly negative to lead may start local action. Platinum and lead, for instance, decompose dilute acid at once; but perhaps traces of arsenic or antimony in the oxides from which the reduced coating has been made, or in the acid, may sometimes produce the same result. Peroxide of lead, on the other hand, is more stable, though when heated with strong sulphuric acid it seems to evolve some oxygen and turn lighter in color.

Electro-gilded copper was attacked at once by sulphuric acid.—*London Electrician.*

Good Times in Dakota—Electricity Keeping to the Front There.

I have been traveling over the northern part of the Territory of Dakota for some time, writes a correspondent, and the more I see of the country the more I am impressed by four of its chief characteristics—its size, soil, climate and productions. Commencing at Grand Forks, I have traveled westward on the Devils Lake division of the St. Paul, Minneapolis and Manitoba Railway, a distance of 207 miles to Minot, the present terminus of the line, and 80 miles farther by team, and I find the country to possess essentially the same characteristics for the entire distance. There is the same black soil, sometimes without a trace of grit, and sometimes with a slight admixture of sand, but always rich and productive, and west of the Red River Valley, a constant succession of gentle undulations, just high enough to furnish drainage and give diversity to the country, while lakes, distributed here and there, furnish a perennial supply of the finest water.

For the first hundred miles the country immediately adjoining the road is now tolerably well settled, yet public lands are not all taken, and excellent opportunities yet remain for securing free homes, for there is still much public land left, and fine business openings can be found in such good towns as Niagara, Michigan City, Lakota, Crary and Devils Lake. The terminus of the railroad for two years was at Devils Lake, but the present season, the building of 118 miles of new track to and through the Mouse River and Turtle Mountain regions, has distributed large sums of money among the settlers, and opened up a virgin country, rich in resources, coal bearing as well as grain and stock raising, and making it possible to have choice for settlement of land as rich and well adapted for mixed farming as any in the country. Besides, opportunities to engage in business are of the best, in such towns as Rugby Junction, Towner and Minot, the natural centers for the trade of large areas of country, while Leeds, York, Knox and Granville present the very best of openings to persons of limited capital to open up in business and work up. Along the Mouse River and in the vicinity of the Turtle Mountains, and in the Antelope valley, settlement is already considerable, and with a market secured for the surplus products the past season by the building of the railroad, trade has and will rapidly increase. The further extension of the road next year, besides the building up of so many towns, of course, will make employment at good prices for all workmen with trades, or laborers, who come to the country, besides giving them opportunity to secure farms from the public domain. Times have been good out there this year, and present indications point to a still further improvement in all lines of business. Several electric light companies have been projected, and everything indicates a progressive people.

The New Incandescent Illuminating Company, of Boston.

The first annual meeting of the Edison Electric Illuminating Company, of Boston, was held in that city, January 5th, 1887. The following Board of Trustees were elected: T. Jefferson Coolige, Boston; W. Powell Mason, Boston; Jacob C. Rogers, Boston; Richard Rogers, Boston; C. T. Christeinsen, New York; C. H. Coster, New York; F. S. Hastings, New York; E H. Johnson, New York; Hubbard Breed, Boston. The officers are Edwd. H. Johnson, president, New York; Hubbard Breed, clerk and treasurer, Boston; F. S. Hastings, assistant clerk and treasurer, New York; W. J. Hammer, manager, Boston; D. W. and W. W. Gooch, general counsel.

This company was organized December 23th, 1885 with a capital stock of $100 000, which has recently been increased to $250,-000. The first district station of the company is situated at Head place, off 23 Boylston street. The district at present operated by the central station is bounded by Tremont, Boylston, Carver and Pleasant streets, Shawmut avenue and Indiana place, Washington, Kneeland, Albany, Kingston. Summer. Milk, Arch, Congress, State and Court street to Tremont street.

After some slight alterations in the existing building on the premises at Head place (off Boylston street), it was occupied with boilers, engines, dynamos, etc., having a capacity of twenty-eight hundred lamps of 16 candle-power, actual burning at any one time. This plant was started on the 20th day of February, 1886. The following table will show the number of lamps in operation during each month:

Month.	Lamps Connected.
February	627 (16 C. P. basis)
March	771 "
April	1,025 "
May	1,805 "
June	2,318 "
July	2 588 "
August	2,773 "
September	3,768 "
October	4,430 "
November	4,645 "
December	4,847 "

A new building is now being erected which wil be one of the finest central stations in this country. It is entirely built of brick and stone, and fireproof throughout; concreted floors. There will be ample room for engines, dynamos and boilers for a maximum capacity of twenty-five thousand lamps, which will enable the company to operate forty thousand lamps throughout their district. The first installment which is being made will give the station a capacity of six thousand lamps at once, and will admit of ten thousand lamps being connected, as not more than sixty per cent. would be in use at any one time.

Since the inception of the station, the company has been extending its system of conductors, which has been an overhead one; and within the last few months has commenced the installation of the Edison Three Wire Underground system, comprising also three flexible callender feeders the whole amounting to between five and six miles of conductors, having a capacity of ten thousand lights. More than three-quarters of this work is already completed; and it is expected that by the time the machinery is in operation in new station, the underground conductors will also be in perfect order. The overhead system will then be taken down.

The company has also made extensive application of its current to the electric transmission of power, and have at the present time thirty Sprague electric motors varying from one-half to ten horse power. This station is in fact the most important electric power station, not only in this country but in the world, and there is every prospect of a very large increase in this portion of their business within the next few months. The New England agency of the Sprague Motor Company represented by H. McL Harding effects the sale of the motors, after which they are placed under the control of the Edison Company, who supply the current at a specified rate per horse-power, according to the conditions in each special case. In some cases this is arranged on a contract basis, and in others the current is measured by meter in the same manner as the light.

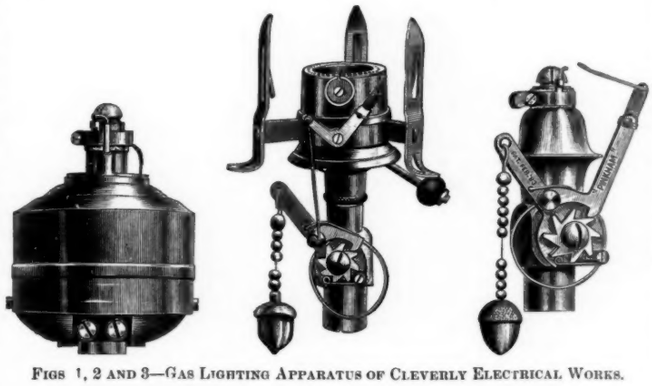
There will be several features in the new station which have not been used in any Edison station in this country. As soon as this plant is in operation, the engines and dynamos in the old building will be removed and the building transformed into a boiler house. There will be seven boilers installed upon the lower floor, and seven on the floor above. And a portion of the space which remains will be arranged for storing fuel; a brick stack of two thousand horse power will also be erected, which will act in conjunction with the old one of six hundred horse-power.

Since the middle of August, the control of the station has been in the hands of Mr. W. J. Hammer, manager and electrician, of the Company; assisted by Mr. E. W. Godfrey, superintendent of construction.

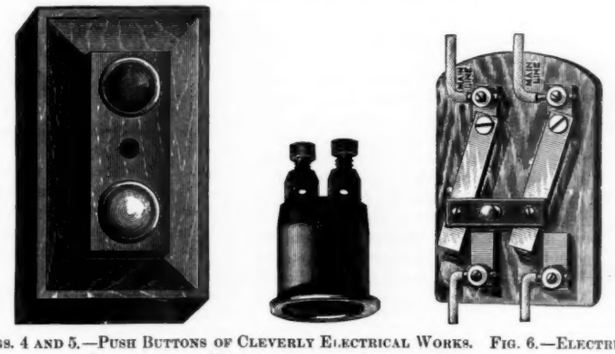
Some of the principal consumers are, the Adams House, 450 lights; the Bijou Theater, 707 light; the Young Men's Christian Union, 400 lights; Bigelow & Kennard, 200 lights

The Electric Gas Burners and other Electrical Apparatus of the Cleverly Electrical Works.

The improved automatic burner manufactured by the Cleverly Electrical Works, of Philadelphia, is one of the most effective and neatest appearing electric gas burners ever brought out, and the manufacturing company is crowded to its fullest capacity with orders for this particular class of electrical goods. The illustration, Fig. 1, shows the improved automatic. Its operation is very simple and well-known to most of our readers Electricity not only lights the gas but turns it on and off by means of the push buttons, or keys. This is accomplished by two pairs of electro-magnets, one on either side of the gas way, governing an armature which by a lever operates the gas cock so that when an electric current is passed through one of the magnets the armature is attracted to that magnet and the lever moves the stopcock and turns on the gas; when a current of electricity is circulated in the other magnet the armature is drawn in tha direction, thus turning off the gas. The automatic has been greatly improved, and is



FIGS 1, 2 AND 3—GAS LIGHTING APPARATUS OF CLEVERLY ELECTRICAL WORKS.



FIGS. 4 AND 5.—PUSH BUTTONS OF CLEVERLY ELECTRICAL WORKS. FIG. 6.—ELECTRIC LIGHT SWITCH, MANUFACTURED BY CLEVERLY COMPANY.

—— The Grand Jury in Brooklyn is engaged in looking into the rights and privileges of the electric companies of that city.

The Mayor of Detroit recommends the creation of an electrical department similar to that of Philadelphia.

Jefferson City, Mo., is now illuminated with electricity for the first time in her history. This is only one of the many improvements made since the last session. The electric light plant is a home enterprise, owned principally by W. W. Wagner and J. C. Fischer. These improvements indicate a determination on the part of the citizens to show that there is no necessity for removing the capital. It is not likely, however, that any attempt will be made this winter on the part of Sedalia to interfere with the location of the capital.

At Omaha, C. G. Barton, agent of the Brush people, has just put in a combination plant, comprising 500 incandescent and 90 arc lights, for the Union Pacific Railroad Company, at Rock Springs, Wyoming Terri ory. Mr. Barton has also closed several other contracts in that vicinity,

fitted with binding posts instead of the loose wires as formerly and new form of shell.

The "Argand" and "Lift over" pendants are also shown. Two special forms of push buttons are shown in Fig. 4 and 5. In Fig 6 is shown an electric light switch manufactured by the Cleverly Company, and which is being used on the underground work in Philadelphia. This switch works without disaster to the current; no flash being perceptible when line is switched.

The following is the report made by the American Electric Manufacturing Company, of this city, at a recent meeting of the directors in this city. A full statement was made of the past year's business, which showed the earnings upon the capital stock, since their new electric lighting apparatus was introduced upon the market, of 10 per cent. A quarterly dividend of 1½ per cent. was declared, payable to all stockholders of record Jan. 25 The balance of the earnings will be carried to surplus account for increasing the company's manufacturing facilities. The dividend declared is expected to be continued regularly every quarter hereafter. A full report of the improvements and inventions made by Professor Wood, the electrician of the American Company was made in writing, covering his entire experience with the company The report showed a number of new inventions and improvements in electric lighting, which will be put in effect within a few months.

The Proof-Reader.

"The proof-reader has long shared with the 'intelligent compositor' the reputation for that total depravity which has made a writer say 'see the pale martyr with shirt on fire;' when he wrote 'in sheet of fire;' and to ask 'is there no barn in Guilford,' when he meant 'is there no balm in Gilead;' to speak of his love of 'alum water,' when he wrote 'Alma Mater,' and to speak of 'a mysterious dispensation of Providence' as a 'mysterious disappearance of provisions.' The silence of the proof-reader has been taken either as evidence of his guilt or that he was proof against reproofs. He has borne contumely long enough, and he rises to 'hurl back' the charges and to 'nail lies to the counter' and to 'thrust the base falsehoods down the throat of his cowardly vituperators,' as the contributors to the popular periodical, the *Congressional Record*, are in the habit of saying The worm has turned at last, and a rather lively turn it is. He expresses his wonder that nothing has ever been said in praise of proof-readers. Of course, this might surprise a proof-reader, but any experienced writer for the press will not be astonished at it at all. The writer will know that he has time and time again written the most glowing eulogies of proof-readers and their assistants—tributes that statesmen might envy and good men crave. But the proof-reader has never allowed them to appear in print. Where the writer has said that the proof-reader was a 'benefactor to his race,' it has appeared 'as a benighted scapegrace;' when he has called him the 'salt of the earth,' it comes to the surface as 'scum of the earth;' when he has spoken of the 'ease and comfort' a good proof-reader gives him, he is made to say an 'escaped convict,' and when he has referred to the proof-reader's 'saintly grace,' the public first learns of it as a 'snake in the grass.' That is why nothing has ever appeared in print in praise of the proof reader. The protesting proof-reader is not willing to believe that every one of his species is 'full of malice toward authors, and hates the whole world.' And then the man actually goes on to speak a good word for himself and his kind. At this rate the barber will be defending his talking; the mother-in-law will clamor for a hearing; the plumber will be piping up in his own behalf; the Chinese laundrymen claiming a right to live an honest and cleanly life, and turkeys speak their minds about Thanksgiving. What is the world coming to? However, since the proof-reader has been graciously allowed to have his say, it is perhaps worth while, as a mild amusement, to hear how he puts the case. In the first place, he says that an author intent on his work is necessarily careless about his hand-writing. He cannot break the flow of his thought to dot his 'i's' and cross his 't's.' Each author has a peculiar penmanship. The proof-reader takes the manuscript and tries to catch the purport of the author's thought. He has scarcely done so, when in comes another mass of proof and manuscript of an entirely different character; and a new thread has to be picked up until another interruption. This is not for a moment, but all night, all the week, all the year. After puzzling himself until he is half blind, his brain weary, and work pushing upon him incessantly, a letter may be left out or a comma inserted in the wrong place, when slam bang goes a volley at the proof-reader! He has seen an author scold a proof-reader for some trifling oversight when that same day the proof-reader had corrected an historical blunder which would have cost the author dearly had it seen the light. He has seen an author brag of his penmanship, and when his manuscript has been sent to him because it was unreadable, he himself was scarcely able to decipher it. It would be well to have a proof-readers' union formed, the members of which should agree to ruin authors by letting the world see their blunders and inaccuracies; for the wrongs of the long-suffering proof-reader are many."

Friend Haskins, of Chicago, can appreciate more than any one else the idiosyncrasies of the proof-reader and compositor.

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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NEW YORK, JANUARY 22, 1887

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The gas people, all over the country, are gradually becoming sensible and accepting the situation, by turning their attention toward electricity as the light of the future, and acknowledging the eventual degradation of gas to the level of a pot boiler.

The American Telephone and Telegraph Company have opened a number of branch offices in Philadelphia, and telephonic service between that city and New York is satisfactorily given. The lines are particularly quiet, and conversation is found to be very clear and easy. As the value of this service becomes better known to the general public, the demand for it will undoubtedly greatly increase.

A number of inquiries come to this office every week seeking information concerning membership in the National Electric Light Association, payment of dues, etc. The number of these would indicate more than usual interest in the next meeting to be held at the Hotel Lafayette, at Philadelphia, February 15, and in reply to the questions asked full and complete information concerning the association will be promptly received by all who write to Mr. T. McCoubray, Secretary of the National Electric Light Association, Baltimore, Md. All records of the association are kept at Baltimore, and those members who desire that all dues standing against them shall be liquidated before the next meeting, should write as above directed.

An ingenious application of photography has been made at the Chancelade quarries, near Perigneux, where an accident occurred, caused by the caving of the walls. Five persons were imprisoned in the rocks, and no means were at hand to rescue them. To find out where they were, a shaft 12 inches in diameter was bored, and down this was slid a tube, near the end of which was a small photographic camera, surrounded by a battery of electric lights. The camera moved on a point, so that it could be poured up or down by pulling a cord. With this apparatus a number of good negatives were taken. The effects of the disaster were located, and excellent pictures of the faces of two corpses were obtained, showing that it was useless to proceed further in the excavations.

Several bills for the regulation of telephone rates have already been introduced into the State Assembly at Albany. One forbids the exaction of more that $3.50 per month in any part of the State; another provides that the rent in this city or Brooklyn shall not exceed $5 per month, and a third fixes a rate of $6.50 for this city and Brooklyn, with lower rates for smaller cities. The people of Rochester and Syracuse are determined not to allow the subject to be neglected or ignored by the Legislature. And all this is the result of the fact that the telephone companies were simply trying at Rochester to secure an equitable adjustment of the business so that each subscriber should pay in proportion to the use he made of the service. This plan has been successfully adopted at Buffalo.

The pronounced success of The Electric Club, of New York, proves conclusively the need of such an organization, and the strength and progressiveness of the electrical fraternity. Although the first papers presented the Club have been from the rapidly extending branch of electricity, known as electric lighting, we are informed by the Entertainment Committee of the Club that a number of interesting papers are being prepared by able hands representing the branches of electric locomotion, long distance telephoning, improvements in telegraphy, and other branches of this most interesting science. The next regular meeting of the Club occurs Thursday evening, February 3, 1887. The list of members now numbers about 130, and the Membership Committee have several applications awaiting action at the meeting of the Board of Managers.

SURGERY WITH THE ELECTRIC WIRE.

The applications of electricity to the treatment of diseases have not reached the successful results anticipated by their advocates for many years; but the methods of applying electricity to surgical operations impossible by any other method of treatment, have resulted in brilliant professional success, and brought health to many a sufferer.

The work of Dr. Rothwell Park and others in this country, and the methods introduced by Leiter in Vienna, have enabled surgeons to perform operations upon internal organs wholly beyond any other means of treatment. In one of our daily contemporaries, we notice an example of an operation by galvano-cautery for the removal of a cancer. The patient submitted to the application of galvano-cautery late in November, for the removal of a cancer which involved nearly one-half of the right side of his tongue, and is now convalescent. The operation was a remarkable one, and was performed by Dr. Baldwin. It was removed successfully by galvano-cautery. On November 23 Mr. Shipley was placed under the influence of chloroform at his house, and in the presence of nine physicians the operation was performed. A needle threaded with silk was passed through the tongue, and that member was drawn out of the mouth as far as possible. Then the base of the cancer was encircled with a loop of fine platinum wire, which was held in place by pins thrust through the cancerous growth. When everything was ready, a current from a powerful battery was sent through the platinum wire, heating it to incandescence. For an instant the interior of the patient's mouth glowed with white light. Then the loop was drawn forward, and the glowing wire cut rapidly through the base of the cancerous growth, leaving a bloodless wound in its track. The cancer, when removed, was as thick and as long as a man's thumb. Two days afterward Mr. Shipley was able to sit in a chair and take liquid food with comfort.

PATENT LEGISLATION.

For the past five years numerous bills have been introduced into Congress, having the ostensible object of protecting innocent purchasers of patent rights, devices or inventions made in accordance with patent rights from the demands of those interested therein or from suits for infringement.

Innocent purchasers include those, who purchase a patent, without knowledge of the interest, or the rights of others, therein. As also those who purchase or use a machine, formula, process or the like, for actual use, without knowledge that the same is covered by a patent or patents owned by others; in plain terms each of the many bills, has been a bill to protect the carelessness, laziness, and a lack of business prudence in those who purchase patent rights, patented device, or similar rights.

The Hon. R. W. Townsend, of Illinois, has lately introduced such a bill, the full text of which we give below, and we especially desire to call the attention of all those interested in patents to the text of this bill. It is manifest that there is no more reason for providing protection for the purchasers of patent rights, than there is for providing similar protection for owners of real property.

If the bill related to real property, and provided that the purchaser of a house and lot be not required to search the title of the property, and further that subsequent to the date of purchase, all others were estopped for setting up any claim to an interest therein, as for instance in the case of an owner of a mortgage, there would be a tremendous hue and cry raised, no one would feel safe, and the business of the country would be in a great measure paralyzed.

The old saw, "Iguorance of the law is no excuse" applies in a measure to all titles of both real and personal property; and he, who by his own carelessness, trespasses upon any right of property, should undoubtedly be held responsible therefor.

That portion of the bill which states the amount required to be involved $200, very clearly demonstrates that the framer of the bill was ignorant of the fact that in the majority of patent suits, where relief is sought in a court of equity, the question of the actual damage sustained is comparatively unimportant, and likewise very difficult to determine, until the patent in suit be judicially construed.

We advise all those whose business is founded upon patent rights to give this matter careful consideration, and communicate with their respective representatives in Congress urging upon them the necessity of doing their utmost to prevent the passage of the bill.

Four-fifths of the business interest of this country is based upon patent-rights, and the passage of such a bill, to merely gratify a few sore-headed grangers who think more of the ten dollars' license fee, which they have had to pay as royalty on their dividends than the material interest of the country at large, would certainly be most iniquitous. In conclusion we would urge you not to neglect this matter, write to your congressmen at once. If every man invested in patents would speak out, Mr. Townsend's bill and others of a similar kind would be consigned to a graceless obscurity.

The following is the text of the bill: H. R No. 4458. Be it enacted, etc., That hereafter the United States District and Circuit Courts shall have no jurisdiction to hear or to try any case arising from the actual use of any patent right, or its infringement by such use, by any person in or citizen of the United States or the Territories, wherein the amount in controversy does not exceed $200 against one person or citizen.

SEC. 2. That purchasers of any patent right for actual use shall not be liable to damages, royalty, or for value of the same, or for infringing the same in any manner, who at the date of such purchase had no knowledge of the claims of any third person, or that the inventor of the same has an interest therein adverse to the seller thereof. That no person who shall in good faith purchase, use, manufacture, or sell without previous knowledge of the existence of a patent therefor, any article, machine, machinery, or other thing for the exclusive use, sale or manufacture of which any patent has been or hereafter may be granted to any person, persons, or corporation whatever, shall be liable, in damages or otherwise, for an infringement of such patent until after written notice of the existence thereof shall have been personally served on such person or persons or corporations, as the case may be, and such infringement shall be thereafter continued.

SEC. 3. That all laws or parts of laws inconsistent herewith are hereby repealed.

SEC. 4. That nothing herein contained shall affect any pending suit or proceeding in any of the courts of the United States or in any court of any of the several States.

——Since writing the above editorial this bill has been considered and failed to receive a majority vote—two-thirds being required to insure its passage.

It was stated in electrical circles last week that President Goff, of the American Electric Manufacturing Company, had secured some new inventions and improvements upon electric light apparatus of great value, and that the company's electrician, Prof. James J. Wood had recently made some valuable discoveries.

It was also reported that they had been offered $500,000 for a transfer of these inventions and discoveries, which offer was declined.

In an interview, Mr. Goff says, he has no particulars to give to the public at present; further than that "he has in his possession improvements upon the present system of electric arc lighting which will so simplify the dynamo machine and lamps that they can be run practically without expert service, and with absolute safety from burning or injury in any way from the electric current." He says, in fact, "I will show you a machine and lamp within a few months which you can run and use with as much ease and safety as any piece of ordinary machinery."

He says "the offer of $500,000 was made and refused as stated." Whatever he secures in this way will undoubtedly be controlled by the American Company. Mr. Goff has given his attorneys instructions to organize the following foreign companies:

British-American Electric Co., capital					$500,000.
Franco	"	"	"	"	500,000.
German	"	"	"	"	500,000.
Australian	"	"	"	"	500,000.
Canadian	"	"	"	"	250,000.

"These new inventions," Mr. Goff continued, "will be transferred to these companies for one-half the capital stock in each company. Prominent capitalists are ready to furnish all the money necessary to carry on the manufacturing under the auspices of each company."

Mr. Goff now expects to sail for Europe in May in the interest of the American Company to look after the proper organization of the above companies. It would seem from what he states that the American Company is now in a strong position in the electric lighting business, and those who know him and are familiar with his contests in the past, and ambitions for his company, will not doubt for one moment that he will take advantage of every opportunity thrown in his way to make the future of the American Electric Manufacturing Company as bright as could be wished for.

CHICAGO ELECTRICAL NEWS.

St. Louis is moving in earnest in the matter of underground. There will now be afforded another opportunity to show the impossibility of working any electric wires underground; that there will be so much retardation that no current will flow except just enough to produce an inductive effect sufficient to prevent anybody hearing anything originating on his own telephone wire, while at the same time he will hear every one else; and the epidemic, malarial racket, can also be worked—the awful consequences of digging up the streets for this particular purpose. How odd it is that subsoiling for any other purpose never breeds either pestilence or parasites, while digging for an electrical trench or subway does this prospectively every time.

A correspondent says that the Mayor has of late been giving his careful attention to the matter of providing some measure that will result in compelling all telephone, telegraph and electric light companies to place their wires underground, and remove the unsightly poles now obstructing the streets and alleys. As no relief can be had from the courts, it has been decided to make an appeal to the State Legislature, and for that purpose "City Counselor Bell has prepared a bill at the direction of the Mayor, which, if passed, will give the city the right to compel the change of the wires underground and the removal of the poles. The ordaining clause shows that it is an act to provide for placing electrical conductors underground in cities of this State of the first-class. The first section provides that every corporation, association or person owning or controlling telegraph, telephone, electric, or other wires or cables, shall have the same placed underground before November 1, 1888."

The directors of the Board of Trade Telegraph Company held a meeting on the 10th instant, and elected E. S. Stokes, president; Frank Gilbert, vice-president; Dwight Townsend, secretary and treasurer; L. D. Parker, assistant secretary.

"Electricity in Therapeutics" was the subject of a lecture by Mrs. Dr. C. M. Haynes before the Women's Homœopathic Society one evening last week. The paper was illustrated by stereoscopic views, and was extremely well received.

Chicago has a world-wide reputation for labor conflicts, and proves every now and then the aptness of the old proverb, "The old cocks crow and the young ones learn." The Baltimore and Ohio night messengers are showing their proficiency in this branch of learning. The strike didn't last long, but it was an "exemplar" all the same. The company sent across the road and borrowed a few A. D. T. blue racers, and the next morning nothing was left of the skirmish, save a small amount of literary effort. One effusion of this sort is perhaps worth republishing:

Night Editor *Tribune* will you Please Put this in the Papers for the Telegraph Boys the Company wrote them up last night and they want to give them a Deal to, and Oblige a Friend.

A strike on the B & O. a call on the Police for Protection of Luten Arch and a squad of Officers to disperse a Monsters assembly of 8 small Boys not Over 16 years old by of the Man they call Jack Lane who wants the night Boys to work after 7 am or till 10 in am or later according to the Route they have to take without any extra pay and all the pay they receive is 15 dollars a month, and every night in the month and they refused to work. By Order of the Committee P. S., The Boys are all willing to go back on the Old time.

They have trouble in Canada also. Down in Quebec there is considerable excitement in the matter of the Great Northwestern and the Montreal Telegraph companies with regard to the nonpayment of the latter's dividend. It is quite generally assumed that the present action is a dodge on the part of the Great Northwestern to throw up its contract, which it can do by simply paying the Montreal Telegraph Company the one-quarter dividend due on the 1st of January, and the amount earned since that time, say one-third of the present quarter, or about $10,000.

The Synchronous Time and Service Company was also licensed on the 12th instant. Capital stock $20,000. Incorporators, J. W. Porter, N. E. Swartwout, and Dwight L. Tripp. The object of this organization is the furnishing of correct time by means of electrically controlled and corrected clocks situated in various portions of the city.

The method of accomplishing this is based on the patents of Millard, Clark, and Eastman. In addition to a regulation of the hands at stated periods, the act of doing this corrects the movement—the rate—of the pendulum itself—shortening this when the clock at the moment of correction is too slow, and lengthening it when the clock hand is fast of correct time. The method is equivalent to having an expert watchmaker "touch up the regulator" for you several times a day without having to wait in the store until a lady customer has been all through the stock, and promises to call again, or having him overdo the "touching-up," first in one and then the other direction, till the whole thing has to be taken in on the watchmaker's dry dock for general repairs.

The action is simply that of a fork actuated by an electro-magnet, which brings back to zero the erring hand—either a minute or second hand—and at the same time, by means of a vertical screw, or a ratchet movement changing the pendulum rate by raising or lowering a lever on which the limiting fork forms the upper extremity of the pendulum, and determines its point of oscillation.

The yearly report of the electric light inspector for 1886 shows a total of work done for the three years ending January 1, 1887:

Lamps Inspected.	Arc.	Incandescent.
1884. 3,053.	1,148.	1,885.
1885. 7,938.	329.	7,609.
1886. 5,704.	479.	5,225.
Totals.... 16,695.	1,956.	14,719.

Chicago, January 16, 1887.

BOSTON ELECTRICAL NEWS.

The Edison Illuminating Company, of Boston, have declared a monthly dividend of one per cent. The result is gratifying to the stockholders, as this is the best-paying station of the Edison Company—a fact due largely to the skill displayed in its equipment and management.

The contracts of the Jarvis Engineering Company with the Brookline and Newton Electric Light companies have been completed. The hanger arm for holding the arc lamps is made of gas pipe, and can be extended or shortened and raised or lowered.

The Boston Electric Lighting Company are to light the offices of the N. Y. & B. Dispatch Company by Sun converters, operated from the Ferdinand street station.

The Bridgeport (Conn.) Electric Light Company have ordered apparatus of the Sun Electric Company, of Woburn, to operate 500 sixteen candle-power incandescent lighting transformers.

There are in various stages of construction several plants for the purpose of distributing current for incandescent lamps with alternate current machines and secondary generators. Details will be given from week to week as progress is made.

The Plymouth Electric Light Company's plant consists of one thirty and one twenty-light, eight ampere unipolar dynamo. The motive-power is a fifty horse-power Armington & Sims engine, which operates fifty looms in addition to the electric light plant. Twenty-one arcs were run on the twenty-lighter and twenty-seven on the thirty-lighter, including thirty incandescents on Sun multiple series distributor boxes. Eight arcs are used by the town for street lighting, and the number is to be increased after the town meeting. The rates charged per evening are for arcs, thirty cents; for each incandescent lamp, five cents.

Wednesday evening Jan. 12, in Tremont Temple, a most interesting and instructive lecture on "Harnessed Lightning" was given by Geo. H. Hartwell, formerly a well-known scientific writer, who for the past three years has devoted himself to popularizing the study of electrical phenomena. A large number of interesting and amusing pictures were thrown on the screen by the aid of a Fuller-Wood arc lamp. The focussing was sharper than can be attained by a calcium light. Pictures of the various makes of dynamo machines were loudly applauded, and the enthusiasm was very great when the portrait of the inventor of the incandescent lamp was shown. A model of the Enos Electric Elevated Railroad was shown operated by current from Julien accumulators. The car was lighted by an incandescent lamp supplied with current from the same batteries. The motors used were of the Daft pattern. A 125 candle-power Bernstein hollow filament lamp was run on the same batteries. Wires from the mains of the Edison Company had been placed in the hall, and lights of various powers and colors were shown. Some excellent coffee was made by heat generated in a coil of wire by the current. A sewing machine, coffee mill, egg-beater were operated by C. & C. motors supplied with current by C. & C. and Volta Pavia batteries. Two 8 candle-power incandescent lamps were operated by twelve 2 qt. Volta Pavia cells. A 3 horse power Sprague motor supplied with current from the Bumpstedd central station drove a small dynamo which supplied 16 incandescent lights. The motor in private installation might be a water motor, gas, hot-air or steam engine.

Boston, Mass., January 19, 1887.

A REPLY TO MR. SELDEN.

To the Editor of Electrical Review:

In reply to Mr. C. Selden's letter in the REVIEW of January 8, in which he recounts his experience with a current of electricity, apparently caused by the escape of steam from a locomotive, it may be said that long ago it was a recognized fact that the vapor of water could give rise to a difference of potential in conducting substances.

Leaving out of the question the phenomena of natural evaporation, which, it is claimed, gives rise to electricity, and is often mentioned as a probable cause of lightning, we may refer to the experiments of Sir W. Armstrong, who found that steam issuing from a confined vessel upon an insulated metal conductor caused a difference of potential between that conductor and the vessel in which the steam is generated. As a result of his experiments he constructed a ponderous machine, consisting of a steam boiler and fire-box standing on insulated legs. This boiler, besides having the usual safety valve and water gauge attachments, was provided with a wooden outlet so constructed that the steam took a sinuous course in escaping, which it did in a number of jets which impinged on metal combs like those of the ordinary frictional machine. These combs were in electrical contact with a large metal conductor which was insulated by being placed on the top of a glass pillar. Some idea of the enormous power of this hydro-electrical machine can be formed when we are told that it was capable of developing sparks of over five or six feet in length. Mr. Selden's partially constructed electric light line was a very similar piece of apparatus. The locomotive, blowing off its pop valve, corresponded to Sir W. Armstrong's boiler, and the insulated electric light line corresponded to his brass conductor, and being charged positively, it, of course, showed a spark when brought close to the wire on the ground, which was at a much lower potential.

Electricity generated in this way has never been put to any practical use.

Very truly yours,
ALLAN V. GARRATT.

BOSTON, Jan. 14, 1887.

Soft wax.—Ordinary beeswax melted and mixed with turpentine, about 10 of wax to 1 of turpentine by weight.

Films of collodion are best made from the least highly nitrogenized gin cotton. The collodion is poured into a clean flask, which is turned round, inverted and drained. When dry, a quill is put down the neck, and the edge of the collodion film twisted upon it; this allows the air to escape as the balloon of collodion leaves the glass. Such balloons, when fractured, serve for electrical experiments. The metal which ranks next to mercury in fusibility is the newly discovered element gallium, which fuses at about the same temperature as ice.

QUERIES AND ANSWERS.

To the Editor of Electrical Review:

a. Can I bore holes in carbon with a twist drill? *b.* Will carbon such as comes from the retorts of gas works do for battery use, and how may I cut it up? OHM.

Answer.—*a.* We have used a twist drill very successfully for this purpose. Use one you do not care for. *b.* Retort gas carbon, which may be obtained for a small amount from any gas works; has no superior for battery use. To cut it use an old saw.

F. M. G.

To the Editor of Electrical Review:

Will you please inform me what I can add to the bichromate solution in my plunge battery to keep the zincs well amalgamated?

X. X. X. X.

Answer.—Add 5 per cent. of a concentrated solution of bisulphate of mercury.

F. M. G.

To the Editor of Electrical Review:

I have studied a little chemistry and know how to test for black oxide of manganese. I applied the test to the contents of a porous cup which had been broken by accident, and got a negative result. C.

Answer.—Some porous cup batteries have no black oxide of manganese in the cup. Others purport to contain it, but do not. Purchase your supplies only of established dealers. F. M. G.

To the Editor of Electrical Review:

I am little, but I read the ELECTRICAL REVIEW. Will you please tell me, do they use kittens to make electricity? I saw two yesterday in a place where they make it.

TOTTIE.

Answer.—If you rub a cat's back on a cold night you will see sparks. Electricity makes the sparks. In the station where you saw the kitties there might have been some mice. It would take too many kittens to supply enough electricity to make even one little electric light. F. M. G.

To the Editor of Electrical Review:

I have a countershaft making 240 turns a minute, on which there is a 15 inch pulley. What sized pulley must I put on my 10 light incandescent dynamo that it may make 1,200 revolutions? T. ZAR,

Xenia, Ohio.

Answer.—Three inches diameter.

To the Editor of Electrical Review:

I have a ½ candle incandescent lamp for surgical purposes, and wish to know how many cells, and of what kind I must use to run it. I tried to use some cells on the bell circuit and got no light. R. HUBARB,

Belfast, Me.

Answer.—From one to three plunge bichromate cells, having a carbon surface in liquid next to the zinc of about 8 square inches. F. M. G.

Telephonic News

*** The Telephone Exchange at Freeport, Ill has 175 subscribers. Telephonic communication is had with 40 towns to a distance of 75 miles.

*** The ice storm at Hartford, last week, caused considerable annoyance to the telephone people. The service was in a badly mixed state, over 150 miles being down Superintendent Stevens states that the storm caused them more inconvenience than any since the great ice storm some four years ago, when 400 wires were down in the city alone. A bad break was reported from Cromwell, and communication with points down the river was in consequence shut off for some hours. The damage had been repaired by 2 o'clock of the same day.

*** The report of the telephone company at St. Paul, Minn., for the year 1886, shows the following progress: "Net gain in subscribers in 1886, 215; miles of new poles erected to connect new subscribers in 1836. 5; miles of pole lines entirely rebuilt in 1886, 10; miles of wire strung to connect new subscribers in 1886, 170; miles of wire strung to replace old wire on lines rebuilt. 150; feet of 50 and 100 conductor cable. 1,000 (cable contained 18 miles wire, and not included in above); total cost of improvement of plant in 1886, $10,686.15; total number of subscribers Dec. 1, 1886, 1,315; average number of daily calls, 11,000; total number operators, 18.

*** District-Attorney Stearns, on behalf of the Government, filed in the United States Circuit Court a bill of complaint of the United States against the American Bell Telephone Company and Alexander Graham Bell in Boston last week, Wednesday. The bill is essentially the same as the one dismissed from the Ohio circuit of the United States Court on the ground of lack of jurisdiction. The bill sets forth at great length the reasons why the Government charges that patents were wrongly issued, the allegations being precisely the same as were contained in the Columbus bill. The only additional allegation of consequence is that Prof. Bell failed to comply with a regulation of the Patent Office, requiring a patentee to file a working model of his invention. The counsel for the Government, besides District-Attorney Stearns, are Solicitor-General George A. Jenks, Acting Attorney General; Allen G. Thurman, John Goode, Grosvenor P. Lowery, Hunton & Chandler and Charles S. Whitman. The answers of the defendants will be due on the first Monday in March, and the case will then take the usual course.

*** The long-talked of telephone company, at Rochester, N. Y., has at last been formed, and the certificate of incorporation was filed last week. The name of the incorporation is the "Western New York Mutual Telegraph and Telephone Company." The certificate states that the incorporators are banded together for the purpose of owning, using and constructing and maintaining a line or lines of electric telegraph from and to divers points within the State of New York, pursuant to an act of the Legislature of the State of New York. The certificate also states that the general route of the line of telegraph shall be from the cities of Auburn and of Elmira, through to the city of Rochester and to the city of Buffalo and the city of Jamestown, along the streets and highways between said points, and the streets of said cities and villages, and connecting said cities and villages with the towns and villages of the following counties of the State, to wit: Chemung, Tompkins, Cayuga, Wayne, Seneca, Schuyler, Steuben, Yates, Ontario, Monroe, Livingston, Allegany, Wyoming, Genesee, Orleans, Niagara, Erie, Cattaraugus, and Chautauqua. The capital stock of the corporation is $1,000, which is divided into shares of $50 each. The term of existence is fifty years. The certificate of incorporation states that the stock may be increased at any time, and from time to time by the resolutions of its board of directors, provided the resolution is adopted by a two-thirds vote of the board; but said increase must not exceed $500,000, nor each share consist of more than $50. The following gentlemen make up the incorporators of the organization: Jonas Jones, Brackett H. Clark, George H. Newell, John Van Voorhis, M. W. Cooke, F. J. Amsden, E. M. Moore, F. H. Vick, C. A. Phillips, E. A. Chase, Henry Likly, F. R. Winne, H. F. Huntington, J. W. Goss, E. H. Davis, J. H. Stedman, H. C. Brewster, and Samuel Sloan.

Repeal of the Telephone Law in Indiana.

TO BE URGED AT THIS SESSION OF THE LEGISLATURE—CONSIDERATIONS PRO AND CON.

One of the questions that will receive attention at the hands of the Legislature is the repeal of the telephone law passed two years ago. The law has been made from the beginning a dead letter in the larger cities of the State of Indiana. In the smaller towns a monthly rental of $3 00 per instrument has been charged by the Central Union Company in accordance with the law. But in Lafayette, Fort Wayne, Richmond, and Indianapolis, the law has been evaded, and what is known as the toll system has been in use for nearly a year.

The telephone people are of the opinion that the toll system is the most equitable one as the patron pays for his instrument according to the use which he makes of it; but it carries with it the necessity of discrimination, for where patrons do not use telephones often enough to make the toll sufficient to pay the fixed charges upon the instrument it becomes a financial temptation to remove it. It is claimed that two-fifths of the instruments in use in the State do not more than pay the amount of the royalty on the instruments, and that the results of the adoption of the toll system is a loss to the operating company, because the toll is too low. It nets, of course, more than the legal rental. In the smaller places where the three-dollar rental is collected, the company also claims to have suffered loss, and President Phillips, who was recently interviewed, claims that the company has not, during the past year, put in any new material in the Indiana plant, because if compelled to operate under the present law, it would rather first pull out altogether.

At the Indianapolis exchange 706 telephones have connections. Two years ago, before there was a law regulating telephones, a thousand instruments were in use. The company claims that the law has only served to demoralize the service, and was not in the first place demanded by the public.

Complaints have been made that the toll system leads to many and material mistakes in making up the monthly accounts. It is not denied by the company that errors have occurred, but that the number of calls charged has been increased so as to make the bill aggregate as much, at least, as the lawful amount, is contradicted by one of the company's employes However, it has been the policy where telephones in use do not net the company enough to pay the royalty, to remove them. This has occasioned no little complaint from those whose instruments have been removed, for they had been getting telephone service at remarkably low rates and under a system which the company itself substituted for the law of the State. Per contra, also, certain patrons have been obliged to pay under the present system, twice and three times the amount of the former rate—$5 per month These are, of course, not well pleased. The aggregate results are not satisfactory to the company, and so it appears that a great many persons are not contented with the present situation.

It is certain that the repeal of the law will be sought. It is understood that if the law were out of the way the telephone company would return to the old system of charges. The old monthly rental ($5) would also probably be re-established. It is reported that the company will urge the reasons for desiring the repeal of the law that it has not enabled the company to make needed improvements and extensions; that it is unpopular legislation and has not been demanded by any considerable body of the people; that the old tax was not oppressive, and yielded only a fair profit.

The opposition to the proposed repeal has not yet developed, if there is to be any. Several of the anti-monopolists who were conspicuous in the last legislature have not been returned but it is not presumed that the repeal will go through without discussion, as there are always cranks to be found who think they know just how to run everybody's business but their own.

The Wires on the Brooklyn Bridge.

The Brooklyn Bridge is more than a high way between two great cities. It serves other purposes than that of permitting many thousands to cross the East River daily without resorting to the ferryboats, which for generations were the only means of communication between New York and Brooklyn

For every pedestrian or passenger on the cars who crosses the aerial connecting link, there is an unseen messenger traversing the structure, bearing tiding of greater or less importance. Hardly a minute passes but what an electric race is in progress right under the feet of those who use the promenade and on a level with the railroad track, but the great tide of travel ebbs and flows regardless of the other tide which is just as restless and regular.

Passengers on the cars cannot but have noticed the wires which are strung along the iron work of the bridge directly under the promenade. The space between the tracks of the railway is occupied almost entirely by these wires. Should any one be sufficiently interested to guess the number he might place it at about fifty, but such an estimate would prove entirely erroneous, for there are no less than 293, including the Commercial cable.

Until the bridge had been completed it was necessary in order to secure telegraph and telephonic connection between the metropolis and the city of homes to sink cables under the East River. That this was a costly undertaking goes almost without the saying, and it need hardly be stated that the corporations interested were quick to see the advantages which the bridge presented over the old method. Requests for permission to utilize the big suspension as a sort of electric conduit poured into the trustees long before the span was completed and a new source of revenue was discovered.

A rental of $30 per year was demanded for each wire, and the telegraph and telephone companies readily agreed to pay the sum. As a result an increase of $9,010 a year is now received by the bridge authorities for privileges which really cost the two cities nothing, but are really worth much more to those to whom they are granted. The Commercial Cable Company pays $250 per annum for the right to rest its cable upon the iron girders of the structure. The largest sum, however, is paid by the Metropolitan Telegraph and Telephone Company, which contributes $5,880 every year towards the maintenance of the bridge as rent for its 196 wires. Considering that this is more than half of the entire amount received for such service the figures give a fair idea of the dimensions which the telephone industry has assumed in a short time. The Baltimore and Ohio has 38 wires, the Western Union has 20 and the Law Telegraph 14. The remainder are owned by private individuals and firms.

"Do you know," remarked one of the conductors as he dreamily lolled in a corner of his car the other day, "I sometimes find myself wondering what messages are flying along all these wires."

If the electric currents could but reveal their burdens to the passing throng there would be little need of newspapers. The secrets which would be brought to light would keep the tongue of gossip wagging furiously until doomsday, and full many a character would stand in its true colors, brighter or blacker, as the case might be ut as this cannot be, the hurrying thousands will cross and recross, never giving a thought to the pulsation of the wires which bring to the bridge trustees a revenue of $9,010 a year.—*N. Y. World.*

Tales of Telegraphy.

Half a dozen or more of the newspaper correspondents of this city were originally telegraph operators, says the Washington correspondent of the New York *Sun*. In the course of a general conversation on the subject of telegraphy the other night a number of interesting reminiscences was stated.

"It was my knowledge of telegraphy," said the correspondent of a prominent Western newspaper, "that enabled me to get a start in newspaper work. Nearly seven years ago the old Cincinnati *Gazette* rented a private wire connecting Gen. Boynton's office in Washington with the editorial rooms of the *Gazette*. I was employed as operator at the Cincinnati end. I had a natural fondness for newspaper reporting, which the city editor encouraged by giving me an assignment occasionally, whenever a pressure of work kept the regular staff otherwise employed. One day Col. Wilson, the railway editor, came into my office.

"'I will give you an opportunity of earning $10 and securing a great deal of credit besides,' said he, dropping into a chair, 'if you succeed in finding a gentleman whose name I will give you, and getting an interview with him. The gentleman is Charles Schiff. He has been sent to this country from England as the representative of the Erlanger syndicate, which is trying to secure a lease of the Cincinnati Southern Railway. You will see at once it is a matter of very general interest to the people of Cincinnati. The officials of the road refuse to talk, and Schiff, who has been in the city several days, cannot be found, although he is registered at the Grand Hotel. Now, if you can find Schiff and get an interview with him, I will see that you receive the proper credit at headquarters for it.'

"I promised to do the best I could, and, without any clearly defined purpose in view, left the office and walked up to the Grand Hotel. The clerk assured me upon inquiry that, although Mr. Schiff was registered there, he had not seen him for several days. What to do next I could'nt tell. Mr. Schiff was a stranger to me. I could form no idea where he was to be found, and in my dilemma I started to leave the hotel. As I did so, two gentlemen entered from the street. As they passed me, the one who was talking, spoke with an accent so English that it instantly occurred to me that this might be the very man I was looking for.

"I retraced my steps, but before I could overtake them they had halted in front of the little telegraph office in the corner, where the one I had overheard began writing a dispatch. I took a position within sound of the instrument and began scribbling away upon a suppositious dispatch myself. The young lady in charge received her pay for the dispatch and started to send it to the central office. I was interested only in the signature. When that was reached the instrument clicked off the name 'Charles Schiff.'

"'Ah! I have found you at last,' was my mental comment; 'now for my interview.'

"Approaching, I introduced myself.

"'How did you know it was I?' he exclaimed in some surprise. I evaded the question the best I could, and proceeded to urge him for the interview, but he cut me short by saying:

"'Will you print it precisely as I dictate if I give you the information?'

"'I promised with great promptness.

'Then,' said he, 'there is but one other condition. Tell me how you knew me. I have put myself to no end of pains to conceal my identity and was flattering myself that I should leave the city to-night and give you all the slip.'

"I gave him the information. He laughed heartily and said: 'You deserve the news for your ingenuity.' We went up to his room, and at the end of an hour the interview was written. The next morning the *Gazette* leaded the story and made it the feature of the paper. The other newspapers printed a brief paragraph, something like this: 'Charles Schiff, of London, whose presence in Cincinnati for several days has had reference, it is believed, to the purchase of the Cincinnati Southern road, left the

city last night for New Orleans without any of the newspaper men being able to secure an interview.'

"This interview gave me the chance I had been seeking to become a reporter.

"I remember," continued the same speaker, "an excusable error I committed while employed in the Boston office some years ago. There lived in Winchendon, Mass., a gentleman of the name of Murdock, the President of the Cheshire Railway Company, a stockholder in a number of local banking houses, and the owner of considerable real estate in Boston. Shortly before the incident I am about to relate happened, Mr. Murdock opened a branch office in Boston. This office was placed in charge of a Mr. Buckminster, whose family resided in Winchendon. One day Murdock telegraphed to Buckminster to mail him at once important papers in a lawsuit. Buckminster was ill at his lodgings with a severe cold, and directed his clerk to telegraph that fact to Murdock in order that Murdock might understand the reason of the delay. The clerk, instead of sending a message fully explaining the matter, merely wrote: "Buckminster is sick.'

"How it happened I never knew, except that I was more dead than alive when I went on duty. When that dispatch reached Winchendon it read: 'Buckminster is dead.' The news traveled fast, and in less than thirty minutes, I am told, the whole town was in an uproar, Mrs. Buckminster passed rapidly from one fainting fit to other. Murdock was frantic with fear lest Buckminster had proved a defaulter and then committed suicide in a moment of remorse, while the friends and neighbors of the deceased man racked their brains for some solution of the mystery. The first south-bound train leaving Winchendon carried with it President Murdock and several of Buckminster's relatives, who proposed to remove Buckminster's body to Winchendon. You can imagine their feelings upon reaching Buckminster's lodgings to find him enjoying the best of health and wondering, until it was explained to him, what it was all about."

"And what did they do with you?" asked one of the company.

"Nothing. I had always rendered faithful services before this occurrence or I would have lost my place, for Murdock made several attempts to have me discharged."

"Speaking of 'bulls'" said another old telegrapher, "I remember one in particular in the case of an elderly maiden lady, who telegraphed her family physician from Saratoga that the waters were not giving her the relief she expected, and to send her a prescription by wire. She received this by telegraph:

"Take a doz. of pills."

"She took them and became so seriously ill that her physician was summoned in great haste. He came to the telegraph office in a towering rage next day and declared that the operator who received the message was nearly responsible for the lady's death. The doctor had said: 'Take a dose of pills.'

"Every telegrapher will tell you how operators quarrel over the wire. The men who are the most quiet and gentlemenly in their personal relations are sometimes the most disagreeable to work with. It is so easy, you know, to call a man a blank fool when several hundred miles of wire separate you, and besides, the fear of the consequences is very slight. I shall never forget an amusing fight I once heard between an operator at Xenia, O., and another at Cincinnati. After each had exhausted his vocabulary of billingsgate the operator at Cincinnati suddenly subsided and refused to continue the contest, whereupon Xenia snapped out:

"'What's the difference between you and a jackass?' Quick as a flash came the reply: 'Just sixty miles. Give me a harder one.'

'Is it true,' asked one of the bystanders, "that an operator's moods may be determined by his manner of using the key?'

"'Beyond a doubt,' was the reply. If you have been in the habit of working regularly with a man you can tell before you exchange half a dozen messages whether he is feeling fresh and buoyant, tired or lazy, or out of sorts, by his manner of transmission. There is as much individuality about a man's sending as about his penmanship, and he can be as readily distinguished by it. A case in point is related by Alf. Saville, who worked one of the government wires between Nashville and Louisville during the war. One day, while the wire was idle, some one at an intermediate station called at the Nashville office and began asking Saville a number of questions about the movements of troops and other matters connected with the army. Before two minutes Saville recognized his man.

"'I say, George Ellsworth, what the devil are you doing there?' flashed Saville, cutting into the middle of a sentence. There was a moment's pause, and then came the answer, slowly and hesitatingly:

"'I 'cut in' on the wire two days ago, and have secured a good deal of information, but I might have got more if I had only kept my mouth (key) shut. Good-by, Alf. I am going.' There was a sudden click of the wire, and then the circuit closed.

"Ellsworth was the celebrated Confederate operator who accompanied John Morgan in his raids through Kentucky and Ohio. Saville and he had worked together before the war, and had become familiar with each other's style."

FIG. 1.

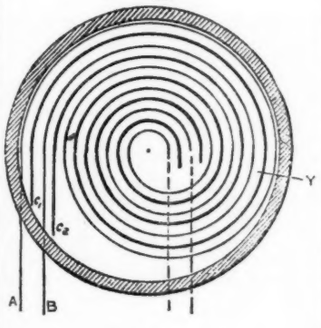
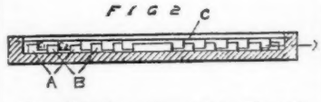


FIG 2.



Lorrain's Improvements in Electric Telephony.

The improvements which Mr. J. G. Lorrain, of Norfolk street, London, W. C., has introduced in connection with electric telephony form the subject of a patent. The object is to construct a long-distance system of electric telephony, and to overcome or avoid the difficulties produced by induction, we are informed by *English Mechanic*. The invention consists of an instrument capable of acting either as a transmitter or as a receiver. When acting as a transmitter, it fulfills the usual function of a transmitter in telephony, namely, that of producing under the influence of sound waves rapid variations of current in a conductor or system of conductors; and when acting as a receiver, it fulfills the usual function of a receiver in telephony, namely, that of producing under the influence of variations of current mechanical vibrations of the air or sound waves similar to and uniform with those which actuate the transmitter. In carrying the invention into effect, the patentee employs an instrument which consists essentially of two conductors and a screen. The two conductors are arranged in proximity to one another, and the screen occupies a position between them. In one form of the instrument the two conductors are fixed, and the screen is movable. In another form the screen is fixed, and the two conductors are movable. In a third form the screen and one of the conductors are fixed, and the other conductor is movable. In a fourth form one of the conductors is fixed, and the other conductor as well as the screen is movable. The patentee prefers to attach the movable part or parts of the instrument to a diaphragm serving the usual purpose of a diaphragm in telephony; that is in order to concentrate or increase the effect of the sound waves upon the movable part or parts when acting as a transmitter, and when acting as a receiver to concentrate or increase the effect of the movable part or parts upon the air so as to produce sound waves or air pulsations. The said conductors may be arranged in any convenient manner. One convenient manner of arranging them is in spirals or coils, and such spirals or coils may be flat, straight or annular. The several parts of the instrument are so disposed with regard to one another that when in action the extent of surface of one conductor exposed to or screened from the other will vary according to the vibrations of the movable part or parts.

When used as a transmitter, the instrument is connected up in such a manner that one of the two conductors shall be in circuit with a battery, or other source or reservoir of electricity, so that a current shall pass through this conductor, and the other conductor is connected to the main circuit. When used as a receiver, the instrument is so arranged that one of the conductors is in connection with the main circuit, and the other conductor is closed upon itself by putting its two ends in electrical connection with each other. For convenience of description, that conductor is called the primary through which the current from the battery or other source or reservoir of electricity is passed, and that the secondary one which is connected to the main circuit—that is in the case of a transmitter; but in the case of the receiver that is called conductor the primary which is in connection with the main circuit, and the secondary the one which is closed upon itself. By the term "main circuit" is meant the circuit connecting the the two stations between which telephonic communication takes place, and which may consist of any of the usual forms of circuit—such, for example, as a metallic circuit or a line and earth circuit. The action of the invention is as follows: Let us take the case where the two conductors are fixed and the screen, in this case attached to a diaphragm, is movable. The sound waves impinging on the diaphragm of the transmitter will cause the screen to vibrate in such manner as to vary the amount of surface of the secondary conductor exposed to the inductive influence of the current in the primary conductor, and so vary the energy of the induced current transmitted through the main circuit. The variations of current passing through the primary conductor of the receiver will cause variations in the current induced in the secondary conductor, and these variations will cause the screen to move in unison with such variations, and so cause vibrations in the diaphragm which will produce sound waves similar to and uniform with those which actuate the transmitter. From this description the action of the invention in the case of the other forms of instrument will be readily understood. In all these forms the effect is the same, whichever parts are fixed and whichever movable—the amount of the one conductor screened from the other will vary with the sound waves in the case of the transmitter, and with the electric undulations or variations of current in the case of the receiver. To increase the inductive action of one coil upon the other, the patentee sometimes employs a core or mass or masses of iron or other magnetic material (but preferably iron); and such a core or mass is called an "intensifier." To gain increased effect the several parts of the instruments are sometimes multiplied for the purpose of transmitting signals, instead of actuating the transmitter by means of sound waves, tapping on the diaphragm where such exists, or tapping on the screen itself is sufficient.

Figs. 1 and 2 show diagrammatically one form of the invention. The primary coil *A* and the secondary coil *B* are formed of thin ribbons of metal wound each in a flat spiral as shown. *C* is a vibrating diaphragm having attached to it the screens c^1 c^2, which interpose more or less between the primary and secondary coils as the diaphragm vibrates. Sometimes in this form of instrument the patentee dispenses with the second screen c^2, and replaces it by a fixed strip of iron acting as an intensifier. Fig. 1 is a sectional plan on line *X*, and Fig. 2 a section on line *Y*. These figures show the instrument as a transmitter. In practice the patentee prefers to use two instruments at each station, one connected up as a transmitter, and the other as a receiver; but he sometimes uses only one instrument at each station; and when this is the case employs a switch, which, when the instrument is to be used as a transmitter, places the primary conductor in circuit with the battery, and connects the secondary conductor with the main circuit; and which, when the instrument is to be used as a receiver, places the primary conductor in connection with the main circuit, and closes the secondary conductor upon itself.

TELEGRAPHIC

.... Mr. Paul Bossart, well known in telephone and telegraphic circles, is doing good work for the electric lighting department of the Western Electric Company in the State of Kansas. Mr. Bossart is a capable electrician, and has a great many friends and acquaintances in the West where electrical plants are in great demand.

.... It is stated that the Pacific Mutual Telegraph Company, of Kansas City, will build the A. T. & S. F. Railway Company's lines from Kansas City to Chicago. This railroad company expect to have their line completed to Chicago by January 1, 1888, and will then own the most direct route from Kansas City to Chicago, and will then extend from the latter city to the Pacific coast and to the Mexican capital.

.... The Chief of the Baltimore Fire Department recommends for his city the keyless boxes, as they are in use in New York, Boston, Chicago and other cities. A gong sounds upon opening them and attracts the attention of those who may be in the neighborhood, so that it is not easy for any one to send in a false alarm without being detected. At night a strong light is thrown upon the box by a reflector, which readily enables persons to see who is sending in an alarm. Chief Hennick also asks for some boxes of the style at present in use.

.... A system of automatically lighting trains by electricity is undergoing experiment in Glasgow, the inventor being Mr. Carswell, assistant engineer of the North British Railway. A central rail is in circuit with a dynamo which is used for supplying current to light the goods' yard at Queen street station, and as a train enters the tunnel it makes contact, and the lamps in the carriages begin to glow, being extinguished as the train leaves the tunnel, and consequently loses contact with the rail. In connection with this question of lighting trains by electricity, the Brighton Company are about to extend their experiments largely, and will make comparative trials with colza-oil lamps.

.... See what an intelligent telegraph operator did for the Western Union Company down in Texas. Mr. Edson had a dog of great price named Shep, and wishing to have him shipped to him, he telegraphs home: "Send Shep by first train." The brainy telegraph operator thought Mr. Edson ought to know how to spell better than that, and so he corrected him and sent the dispatch as follows: "Send sheep by first train." As Edson was a sheep raiser his hired man put his entire flock on the cars, and in a day or two he received notice that they were at hand. Just then a storm came up and many of them fell sick. Before he could get them back to his ranch half of them were dead, and the affair cost him a great deal of money. He is now suing the company for damages, and is liable to get them.—*Philadelphia Press.*

.... The dispute between the citizens of East Orange, N. J., and the New York and New Jersey Telephone Company as to the right of the latter to erect poles on the streets of the township, was settled by Chancellor Runyon. The Chancellor decided that it is not legal for a company to erect poles in front of a house without the permission of the owner, and that, therefore, the telephone company acted in an illegal manner when they erected the poles on Park avenue and Prospect street, East Orange. He decided that as the company acted unlawfully it was their duty to make reparation by taking down the poles they had already erected. The telephone company have a number of subscribers on Park avenue and Prospect street, and in order to run their wires to these places they must keep in position the poles they have already erected.

ELECTRICAL AND SCIENTIFIC

* * A secondary battery has been patented by Messrs. Victor Sass and Karl Friederich, of Berlin, Germany. The electrodes for accumulators are made by heating the zinc and lead together in equal parts, and then heating the composition until a complete oxidation of the lead sets in, after which the heated pliable mass is formed into plates, from which the zinc is dissolved by the use of dilute sulphuric acid.

* * A certain editor of a weekly newspaper made a practice of 'stopping the press to announce," if he had nothing more important to announce than a dog fight. One week everything was dull as a patent office report, but the ruling passion cropped out as follows: "We stop the press to announce that nothing has occurred since we went to press of sufficient interest to induce us to stop the press to announce it."

Electric Transmission of Power.

The question of transmisson of motive power to a distance is still greatly interesting the scientific world and the public as well; Mr. Hippolyte Fontaine's recent experiments bring a new element to the study of this interesting problem; we are going to show their results, giving at first a short historical account of the question considering the practical results attained.

Without being able to indicate exactly the origin or the idea of transmission of electric power at a distance—it was, in fact, accomplished in the magnetic transmitter of Wheatstone—it was in the year 1873 that the first experiment was made with this especial purpose in view at the Vienna Exhibition. This is the way in which Mr. Hippolyte Fontaine, the author of this experiment, describes it in the *Industrial Revue* of 1873. The Gramme machines have, at Vienna, furnished the occasion to carry on an experiment which some day may be applied on a large scale. A primary machine was worked by a gas motor, and the electricity produced by it was sent into a secondary machine, which operated a small centrifugal pump. As we had no measuring apparatus, it was impossible to ascertain the useful work; nevertheless these first trials demonstrated not only of transmitting power to a great distance, but they have shown that the efficiency was sensibly greater than when the other apparatus was used.

In Mr. Hippolyte Fontaine's estimation, the transmitted power amounted to one-third of horse and the distance was equivalent to 7 ohms.

From that time, therefore, it was a realized fact.

There is, meanwhile, the way in which Mr. Fontaine reports before the Société française de physique (meeting of 3d December, 1886), the progress of this then nascent industry:

At Philadelphia, in 1876, the Gramme Company exhibited a transmission of power from 2 to 3 horses through a resistance of 20 ohms.

At Paris, in 1878, the same company was exhibiting a real distribution of power; the same generating machine operated, simultaneously or separately, a pump, a ventilator and a type printing press.

All these public proofs did not succeed in attracting the manufacturers' attention upon the new method of transmission; the great experiments of ploughing by electricity, made at Sermaize, in 1879, by Messrs Chrétien and Félix, were necessary to cause it to enter into actual practice. The Gramme machines used by M. M. Chrétien and Félix were revolving at a speed of 1400 turns per minute, producing a current of about 20 amperes and 40 volts.

From 1879, the industrial applications are on the increase, and at the electrical exhibition in 1881, there were more than 50 machines used for electrical transmissions.

Since the 1881 exhibition they do not count the applications made in different places, always by the use of the Gramme machines or of machines of the same type, in view of transmitting medium powers to medium distances.

The difficulty increases with the distance of transmission, or, more exactly, with the resistance of the line which is to connect the generating with the receiving machines. It becomes then necessary to not expend all the electrical energy on the line, to reduce the strength of the current and to increase the initial tension, as had already been indicated, since 1879, by Messrs. Thomson and Houston, in the journal of the Franklin Institute, (January, 1879). After having well exposed the necessity of using such high tensions, Messrs. Thomson and Houston say:

"Apart from these theoretical considerations, there remains the important fact that with a cable of very limited section, an enormous mechanical power can be transmitted to a great distance. The burning of coal at the mine pit and the transmission of the mechanical power produced by rivers can be therefore considered as feasible, keeping, however, always in mind that a loss of 50 per cent. will be almost unavoidable."

This fatalistic figure of 50 per cent. is to be remarked, because, it is to be found over again, almost alike, in most of the experiments made so far, and it has been found impossible to go much beyond it.

One may ask why then were the experiments which we are about to describe carried on, since their author himself did not believe that they would practically succeed? One more quotation from his statement will give us the key thereof.

If Mr. Hippolyte Fontaine has begun new experiments of transmission to a great distance, it is only to demonstrate that the machines devised and constructed by Mr. Gramme are lighter, cheaper, better, in every respect, than those recently experimented upon at the Northern Railway.

This being excepted, and the need of such course being easily understood, we can go on and describe the experimental arrangements at the laboratory of the electric company, by Mr. Hippolyte Fontaine with the help of Messrs. Nysten, Dehenne and Chrétien.

The transmission is accomplished by the means of seven machines of the same type, called superior type, manufactured by the inventor, Mr. Gramme; four of these machines are used for generating, and three for receiving electricity. Each one develops, at an angular normal speed of 1,400 turns per minute, an electromotive force of 1,600 volts and a current of 10 amperes. The four generating machines excited in series are arranged in tension with the three receiving ones which are themselves connected in tension with a resistance of 100 ohms. The resistance of the induced circuit is 4.75 ohms, while that of the inducing circuit is 6 5 ohms, or 179 ohms about for the resistance of the whole circuit.

The four generating machines receive the movement by the means of two friction pulleys mounted upon an arbor controlled by the workshop machine. These machines are pivoted upon an axle placed under their base, and some properly bent springs regulate the pressure of the rollers against the controlling pulleys. It is an improvement upon the system used at Sermaize in the experiments of electric ploughing.

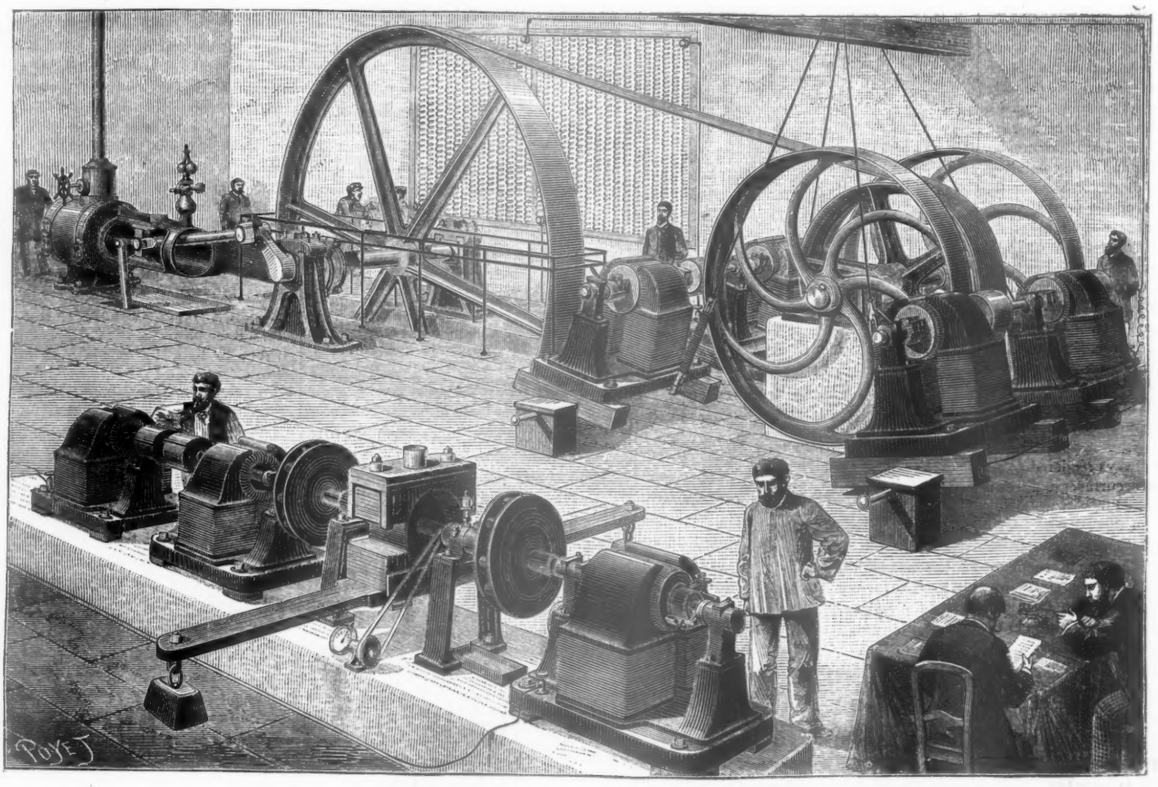
At the receiving station the three Gramme machines are mounted end to end and connected together by coupling plates of Raffard system; the mechanical power which it developed is measured by the means of a Prony brake placed between the first and the second machine The total weight of the seven machines is 8.400 kilograms, and their total price is 16.500 francs.

The chief features of the 19th of October 1886 experiments are tabulated as follows:

Speed of Gramme generating machines	1,298 turn per min.
Difference of potential at the beginning of the conducting line	2,596 volts.
Current strength	9.34 amperes.
Power received by the controlling shaft	95.88 horses.
Speed of the receiving machines	1,120 turns per min.
Power collected at brake	49.98 horses.
Industrial efficiency	52 per cent.

The fact proved by these experiments is, that with 7 Gramme machines of the ordinary type, weighing 9 tons and costing 16,500 francs, it is possible to transmit a useful mechanical power of 60 horses through a 100 ohms. resistance with an industrial efficiency of 50 per 100 But it would be a very remote conclusion to infer from the above experiment that power obtained from natural forces could be utilized at 50 kilometers therefrom. It is not enough, indeed, to produce this motive power at a distance, it must also be distributed, so to say, in several distinct packages, working independently one from the other with a satisfactory result.

Until to-day the problem remains unsolved. We do not mean to say that it cannot be solved—the national use of accumulators will cause many drawbacks to disappear—but it is not yet solved, and none of the experiments made during these last years has shown a proper solving, for they could



Experiments of Hippolyte Fontaine in Transmission of Power.

* * The Citizens' Gas Co., of Jacksonville, Fla., are making a splendid record in the electric lighting business. The Co., under the efficient management of Pres't. Hubbard, is being conducted on a liberal and business-like basis. Mr. Hubbard was one of the first of the gas presidents to recognize the practicability of uniting the gas and electric light business under one management. The American system is in use, and is giving splendid satisfaction, and the business is constantly increasing. Another 50 light American dynamo was shipped by the American Company last week.

* * The Edison people have just completed a 50-light installation at St. Joseph, Mo., for the Moskaska Manufacturing Company, through Mr. Steward, of the St. Joseph Electric Light and Power Company, and Mr. S. has several smaller contracts for future isolated plants of the same sort. Perhaps the finest Edison station in the West is located at Topeka, which is expected to be running by the first of February. The initiation of the system will consist of the combined flashing of 2.000 glow lamps. The capacity of the plant is 5,000 lights, and the station is a model one in every respect. The Brush Company also are running up to heir full capacity.

not admit as being a practical one, the systems by which a single general transmission operates an electric generating machine which sends the current in turn in other receiving machines, thus inserting four intermediate pieces of machinery of transformations between the first motor and the receiving apparatus, thus reducing the efficiency by 15 or 20 per cent.

They must then distinguish—this is of utmost importance—between the transmitting and distributing to a small or medium distance, as is done constantly in actual practice, and of which many examples can be given, such as the ventilating of the Hotel de Ville and of the Ecole Centrale, of the Eastern Railway, Aubervilliers and Roubaix storage houses, etc., etc., and between the transmissions to a great distance, with high tensions, for the purpose of utilizing natural motive forces so improperly called gratuitous ones. It is not necessary to go to a great reckoning to demonstrate that, most often, the best transporting system in an economical point of view, is the transportation of the coal itself, which still for long years to come will realize in the simplest and most economical way the transportation and the distributing of motive power to great distances.—*La Nature.*

New England Insurance Exchange.

The following resolution was offered by the committee on electric lights at the meeting of December 18, 1886. It was laid upon the table to be taken up for action at a future meeting.

The committee recommend the accompanying form of guaranty and schedule of reductions:

Resolved, That the committee on electric lights is hereby authorized to prepare a schedule of allowances or reduction in tariff rates, on special hazard, for the exclusive use of electric lights.

Provided, That said allowance shall not in any case exceed $\frac{15}{100}$ of one per cent.

That no allowance shall be made until the electric light apparatus shall have been approved by the Inspector of the "Exchange," nor until the owners or controllers of said apparatus shall have signed a certificate agreeing that no change in the apparatus shall be made without prompt notice to the "Exchange."

That no allowance shall be made on any policy in force previous to the introduction and approval of electric lights, except that such policies may be cancelled pro rata to take the benefit of the allowance, if rewritten for a term of not less than one year.

That this allowance is not intended to apply to any risk rated by the "Exchange" where the exclusive use of electric lights was considered in making said rate.

And *provided*, also, that no allowance shall be made for the apparatus of any electric light company or system, that has not complied with all the conditions and requirements of the "Exchange."

GUARANTY TO USE ELECTRIC LIGHT ONLY.

New England Insurance Exchange.

(Form B. B.)

In consideration of a reduction of —— cents in the rate of premium on the property hereby insured, it is agreed and guaranteed on the part of the assured that no artificial light shall be used on the premises during the continuance of this insurance except Electric Light, the same having been approved by the Inspector of the New England Insurance Exchange, and his certificate of approval filed with the assured.

Provided, however, That ordinary coal gas or kerosene oil of legal standard quality, in approved safety lamps, may be used without notice, not exceeding five days in any one year, in case of necessity by reason of accident to the electric light apparatus or otherwise. It is understood and agreed that oil lanterns may be used by night watchmen.

A reduction in tariff rates as indicated below, will be allowed for the exclusive use of electric lights, as provided in the Guaranty form B.B., in the following cases of special hazard, viz.:

FOR INCANDESCENT LIGHTS IN

wood-workers' shops, rubber factories using naphtha or benzine, kerosene oil refineries, paint and oil mills using naphtha or benzine, flax and linen mills, cotton and woolen factories of all kinds, flour mills, chemical works, distilleries including vinegar factories from 15 cents to 10 cents reduction.

For either arc or incandescent lights in nearly all other special hazards, 10 cents.

Legal Bureau for the National Electric Light Association.

At the Detroit meeting of the National Electric Light Association a paper was presented by Mr. Arthur Steuart upon the importance to all persons engaged in the electric lighting business of a means through which they could learn at a moderate cost the status of any patent upon apparatus which they are called upon or compelled to use, and it was pointed out that if the members of the Association knew the exact status of the various patents relative to electrical lighting apparatus they would save a large percentage of their present expenses.

The Executive Committee of the Association have considered how best to accomplish this result. To do it thoroughly would entail a cost which, while they believe the members would be amply compensated for the outlay, they still feel themselves constrained not to impose upon them at this stage. The Bureau has been organized, however, on the basis that each member himself bear the cost of the investigations made for him, leaving the future to determine whether the members will prefer this method or pay each an annual tax for the support of the Bureau. The advantage of the latter method would be that the tax upon each member would be small, and there would be no restraint put upon them in making use of the department.

The following is the official announcement of the Executive Committee:

PHILADELPHIA, PA., Dec. 27, 1886.

To the Members of the National Electric Light Association:

Pursuant to the resolution passed at the August meeting to the association at Detroit, a Legal Department to the Bureau of Statistics has been organized, and the use of it is now offered to the members. The Executive Committee have placed this department in the hands of Mr. Arthur Steuart, of Baltimore, and feel confident in recommending him as a gentleman of integrity and ability to the association.

OBJECT OF LEGAL DEPARTMENT.

The legal department is provided for the purpose of giving the members an opportunity of having:

1. their patents; 2, those under which they are licensees; 3, those upon which suit is threatened against them; and, 4, those presented to them for investment; examined by a competent patent lawyer and passed upon at the minimum cost.

PLAN OF WORK.

The method of work will be as follows:

When a patent is submitted to the General Counsel for examination, he will himself, or by competent agent, make a thorough examination of all American and foreign patents, upon the same subject, as well as other sources of information available for this purpose, and prepare as elaborate an opinion as may be necessary with reference to the validity, scope and freedom from infringement of the patent. This opinion, when prepared, will be submitted to a committee consisting of the Custodian of the Bureau of Statistics and such other persons as may be designated by the Executive Committee, who will consider it with the General Counsel, and certify their conclusions to the member making the inquiry. This opinion will be filed, and will become a part of the record of the bureau.

CHARGES.

All work done by the department must be paid for by the member ordering it.

In consequence of the varied character of the work it is impossible to fix any scale of prices, so that the members are requested to arrange with the counsel the matter of charges before work is begun.

In the event of any question arising with reference to the amount to be paid for any particular piece of work, the matter can be referred to the executive committee, whose decision will be binding upon both member and counsel

A. J. DECAMP,
Chairman Ex. Com.

For the convenience of members, it is stated that Mr. Steuart has an office in Washington, at No. 605 Seventh street; in Baltimore, at No. 213 East German street; and in New York, at No. 137 Broadway; so that if consultation with him is desired, it can be had in the place most convenient to the member, by appointment. All communications by mail should be addressed to Baltimore.

Lighting Passenger Cars.

The best methods of heating and lighting cars in passenger service are problems that at present are receiving more than usual attention from the public. Anything that tends to solve these problems deserves careful attention, and railroad managers will be the first to greet the solution with pleasure. The Boston & Albany railroad undoubtedly has as good a system of heating its cars as any yet practically applied, and, as has been previously stated in the Boston *Herald*, it is experimenting with a system of heating with steam from the engine which promises to prove even better than the system now in use. It has tried, or rather has permitted inventors to try, various methods of lighting its cars with electricity. Heretofore these attempts have failed when put into practical operation, the use of primary batteries having been the principle employed. Now, however, a new way is being tested, and apparently it is to prove a success.

The first test of the new method was made last week on the 4.45 train on the Circuit road. The car No. 90 has been fitted up with 10 incandescent lamps of 25 candle-power, while each platform is lighted by another lamp. The interior lamps yesterday were fitted with heavy cut glass globes, which seemed to mellow and diffuse the light, while at the same time very little of its brilliancy was lost. The power or light was derived from two storage batteries or accumulators placed in suitable receptacles under the car, and these storage batteries were said to be sufficient to supply the lights 8½ hours. The Julien Electric Company, of New York, equipped the car under the personal supervision of Mr. Woodworth, agent of the company, and Mr. C. M. Wilder, its Boston resident electric engineer. The car was better lighted than it ever was with oil lamps, but still it is probable more lights will be put in, though the candle power of each will be decreased. It is said that there is no difficulty in getting all the light that is wanted, as the accumulators can be increased to any size desired. It is claimed that the great objection to storage batteries heretofore has been their short life, but that Mr. Julien has invented a new metal for the supporting plates whereby the life of the battery is almost indefinitely prolonged; indeed, that experiments have shown that, after 18 months use, they are as healthy and serviceable as when they were made.

—— The American Electric Manufacturing Company expect to have the new plant, now building for the Orange (N. J.) Gas Company completed in about two weeks.

—— The New York Safety Light Heat and Power Company has been incorporated with a capital of $250,000. The incorporators are C. H. Jackson, of Pittsburgh; W. C. Kerr, Henry H. Kerr, and Chas. S. Pease, of New York.

—— The South Side Electric Light Company has been organized to do business in Islip, Suffolk County, N. Y. Capital, $5,000. Incorporators: William Henry Baldwin, White Plains; Horace E. Baldwin, Flushing; William P. Reid, of Babylon.

—— The electric lighting in Biddeford, Me., is rapidly increasing. The Traders' Electric Light Company, under the presidency of Mr. O. F. Page, treasurer of the Biddeford Savings Bank, has scored a great success. The company adopted the American dynamo and lamps, which is highly spoken of by our correspondent. The company are adding a new boiler and engine to the plant, and have just sent the American Company an order for another large machine and lamps.

—— The Topeka Press Club at its regular meeting spent considerable time in discussing the gas bill. Their gas bill for the month of December was $8.00; there are two burners in the room, and they were used three evenings during the month, so that gas was burned about ten hours altogether; the club figures that this is at about the rate of 80 cents per hour. It was the unanimous opinion of the members that if this was continued the club would be financially "busted" in a very short time, and they decided to use incandescent electric light instead, which is a much better light, and under present gas charges certainly cheaper.

ELECTRIC LIGHT NEWS

—— Electric arc light lamps have been reduced to $5 per month at Jamestown, N. Y.

—— The Seymour (Ind.) Electric Light Company has been incorporated, with a capital stock of $20,000.

—— The city of Freeport, Ill., is illuminated by a splendid electric system of 45 arc lights, costing the city $4,500 per year. The electric plant cost $20,000.

—— At Kansas City, Mr. T. B. Bailey, of the Thomson-Houston Company, reports business good, he having sold several isolated plants in Missouri and Kansas within a few weeks.

—— The St. Paul Gas Company are making a splendid record in electric lighting. Treasurer E. I. Frost says the American system of electric lighting is giving the best of satisfaction, and that he expects more than double his capacity this year. An additional 50 light machine and lamps were shipped last week by the American Company.

—— The American Electric Manufacturing Company are making preparations for opening their new factory in New Haven, Conn. As soon as the engine and boiler house, and a new chimney can be built, the new machinery will be ready for moving into the building. The main factory will be two stories in height; 200 feet wide by 300 feet in length. This will give the company ample room for turning out 500 lamps' capacity per week.

—— A fire at the station of the Rhode Island Electric Company, Providence, last Saturday suffocated the engineer, Geo. Higgins, and fatally burned the fireman, Patrick O'Brien. The fire was extinguished before much damage was done to the station building. No estimate of the damage can be made until twenty-two dynamos are tested. The fire throws out of use 250 arc lights, including 88 in the city's service, and 700 incandescent lights.

—— The incandescent system of electric lighting has been introduced recently into the *Morning News* building, Savannah, Ga., and that journal is well pleased with it, as the following account proves.:

"All over, from basement to the upper tower, nine floors in all, the building is furnished with the incandescent light. There are just 157 of them altogether, and they save a big gas bill. The dynamo down in the basement is run by a 12-horse power engine, which has all it can do to keep the armature revolving 1,150 times a minute so as to grind out the current. There is not much difference in the principle between the generation of the electricity for the incandescent system and for the arc light system. The current for the latter system is intense. It is carried over a small wire, and goes with great force. A large copper wire is used for the current in the incandescent system. It is more like a big wave moving with little force, and is not dangerous to fool with, as the intense current is. A reporter found that out last night by touching the positive and negative field wires where they connect with the dynamo. The electrician afterward told him that if he was to make a similar experiment with an intense current some other reporter would have an obituary to write. Over a mile of wire was used in putting in the system, not counting, of course, the miles of fine wire wound tightly around the coils in the dynamo. Every light is suspended from the ceiling by an insulated wire, which looks like a neat cord. The current is turned on by turning a key very much as gas is turned on, only there is the advantage about the electricity that there is no trouble with headless matches. There is no smell about the electric light, and it is softer, steadier and superior to the gas. One of the lights of seventy volts is about equal to two ordinary gas jets. The light is white and perfectly steady, rather dazzling to look at, but excellent with a shade. The lights are preferred by the employes of the newspaper office to any other kind of illumination ever tried, excepting only the sun. The snake editor, perhaps, ought to be excepted, as he kicks about the light because he cannot get at it to light his cigar on account of the glass globe. He swears that this generation is too far advanced and too progressive."

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JAN 11, 1887.

355,685 and 355,687 Telephone; Charles E. Egan, Columbus, Ohio, assignor of one-half to W. Y. Miles, same place.

355,686 Telephone transmitter; Charles E. Egan, Columbus, Ohio, assignor of one-half to W. Y. Miles, same place.

355,714 Method of drying incandescent electric lamp bulbs; Albert L. Reinmann, Pittsburgh, Pa.

355,729 Regulator for electro-magnetic motors; William L. Stevens, Dorchester, Mass.

355,734 Magneto telephone; Henry E. Waite, New York, N. Y., assignor to Charles F. Livermore, trustee, same place.

355,739 Electro-magnetic cut-out; Fred. H. Wilmarth, Peoria, Ill., assignor of one-half to Frank A. Miller, same place.

355,741 Telephone cabinet; Charles Wittenberg, Indianapolis, Ind., assignor to Edward G. Cornelius, same place.

355,742 Alarm and register attachment for telephones; Charles Wittenberg, Indianapolis, Ind., assignor to Edward G. Cornelius, same place.

355,743 Telephone register; Charles Wittenberg, Indianapolis, Ind., assignor to Edward G. Cornelius, same place.

355,744 and 355,746 Telephone toll collector and register; Charles Wittenberg, Indianapolis, Ind., assignor to Edward G. Cornelius, same place.

355,745 Register attachment for telephones; Chas. Wittenberg, Indianapolis, Ind., assignor to Edward G. Cornelius, same place.

355,753 Means for preventing noise occasioned by vibration of telegraph wires; Paul E. Bardonnaut, Toulouse, France.

355,771 Electric motor; Jacob H. Linville, Philadelphia, Pa., assignor to the International Printing Telegraph Co., Camden, N. J.

355,791 Electric annunciator; Paul Seiler, San Francisco, Cal.

355,793 Safeguard against boiler explosions; John E. Siebel, Chicago, Ill.

355,798 Conduit for electric wires; George D. Sutton, New York, N. Y., assignor to George D. Sutton, Jr., same place.

355,815 Magneto-water level indicator; John J. Ghegan, Newark, N. J.

355,820 Circuit breaker for primary electric clocks; Vitalis Himmer, New York, N. Y.

355,838 Telephone transmitter; Harry P. Pratt, Chicago, and Leon O. McPherson, Jefferson, Cook County, Ill.

355,850 Railway time signal; H. Albert Wayne, Fort Plain, N. Y.

355,860 Telegraphy; Robert G. Brown, Brooklyn, assignor to the Standard Multiplex Telegraph Company, New York, N. Y.

BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court [7 Beekman St.,] New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N.S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World*'s Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer.*

THE ANNUAL MEETING

—OF—

The National Electric Light Assoc'n.

WILL BE HELD IN PHILADELPHIA,

—AT THE—

HOTEL LAFAYETTE,

—ON—

TUESDAY, FEBRUARY 15, '87

AT 12 O'CLOCK M.

The Executive Committee will meet at the same place on Monday the 14th, at 3 P. M.

Members requiring Hotel Accommodations will please address,

A. J. DE CAMP,

Chairman Executive Com.,

Stating what is required.

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MANUFACTURERS OF

ELECTRICAL APPLIANCES

Special Tools and Dies. Model and Experimental Work a specialty.

Nos. 53 and 55 North Seventh Street, Philadelphia.

Fig.259

PHOENIX GLASS COMPANY,

(Works, Water Cure, Beaver County, Penn.)

Fig.255

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The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

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R. H. WHITNEY.

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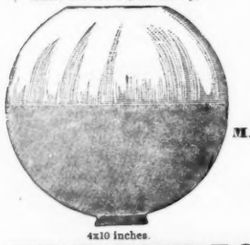

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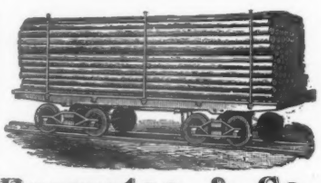

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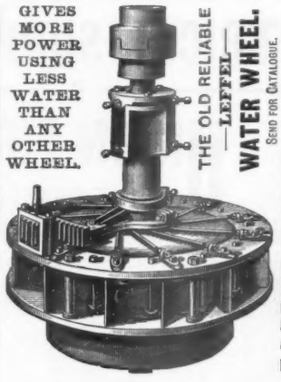

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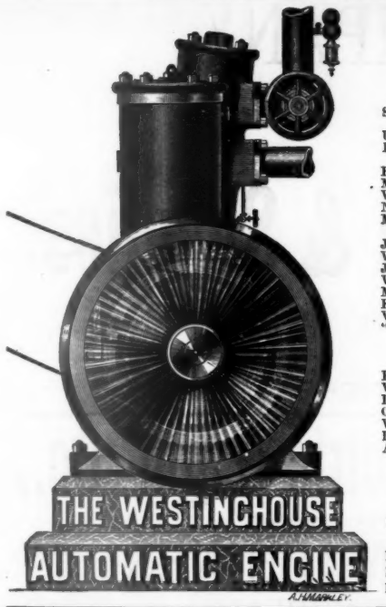

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Wahoo E. L. Co.,		Wahoo, Neb.	60
J. C. Livingston & Co.,		Little Falls, N. Y,	45
Weidman Silk Dyeing Co ,		Paterson, N. J.	45
Miller, Broudy & Co.,		Alexandria, La.	45
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Van Deventer & Horne,		Plainfield, N. J.,	35
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E. Balbach & Son,	14th order,	" "	35
Wolff & Hamaker,		Chambersburg, Pa.	35
Imperial Guano Co.,		Norfolk, Va.	35
Chandler & Price,		Cleveland, O.	35
Wabash, St. L. & Pacific R. R.	2d order,	Ft. Wayne, Ind.	35
Barnes Bros.,		Maquoketa, Ia.	35
A. J. Mullen,		Selma, Ala.	35

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Crown Mills,		Marcellus, N. Y.	25
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Wabash, St. L. & Pacific R. R.	3d order,	Ft. Wayne, Ind.	25
Minneapolis Gas Light Co.,		Minneapolis, Minn.	25
" " "	2d order,	" "	25
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E. Balbach & Son,	15th order,	Newark, N. J.	15
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Shickle, Harrison & Howard	2d order,	St. Louis, Mo.	15
Mecord, Ford & Co.,		Colfax, W. T.	15
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Lawrence Machine Shop,	15th order,	Lawrence, Mass.	10
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F. S. Cole,		Grundy City, Ia.	10
Union Pacific R. R ,	2d order,	Omaha, Neb.	10
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Merritt W. Burwell,		New Haven, Ct.	5
Westinghouse Electric Co.,	3d order,	Pittsburgh, Pa.	5
Lawrence Machine Shop,	17th order,	Lawrence, Mass.	5
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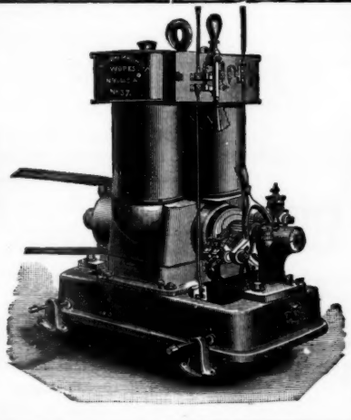

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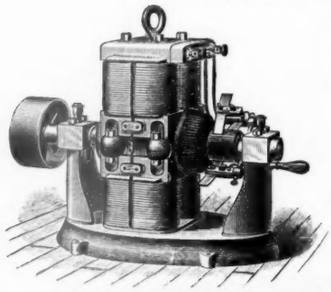

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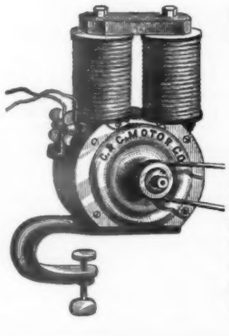

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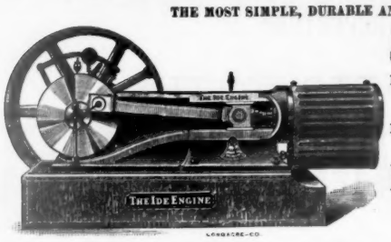

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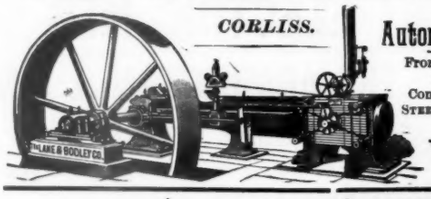

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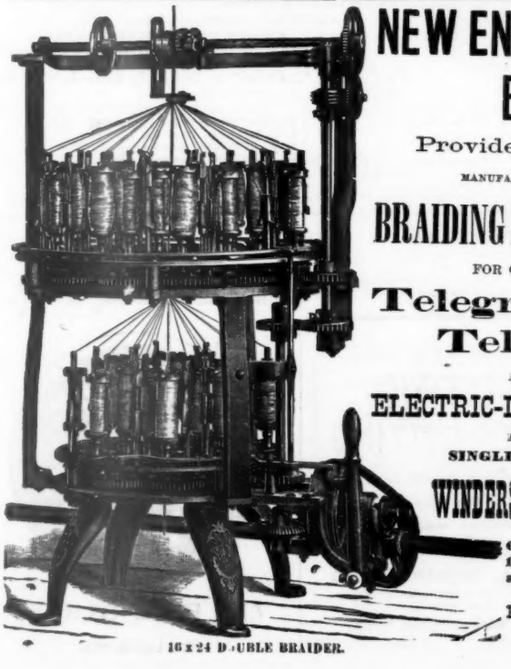

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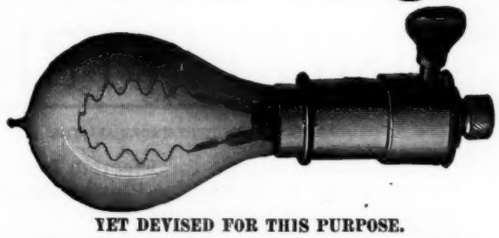

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